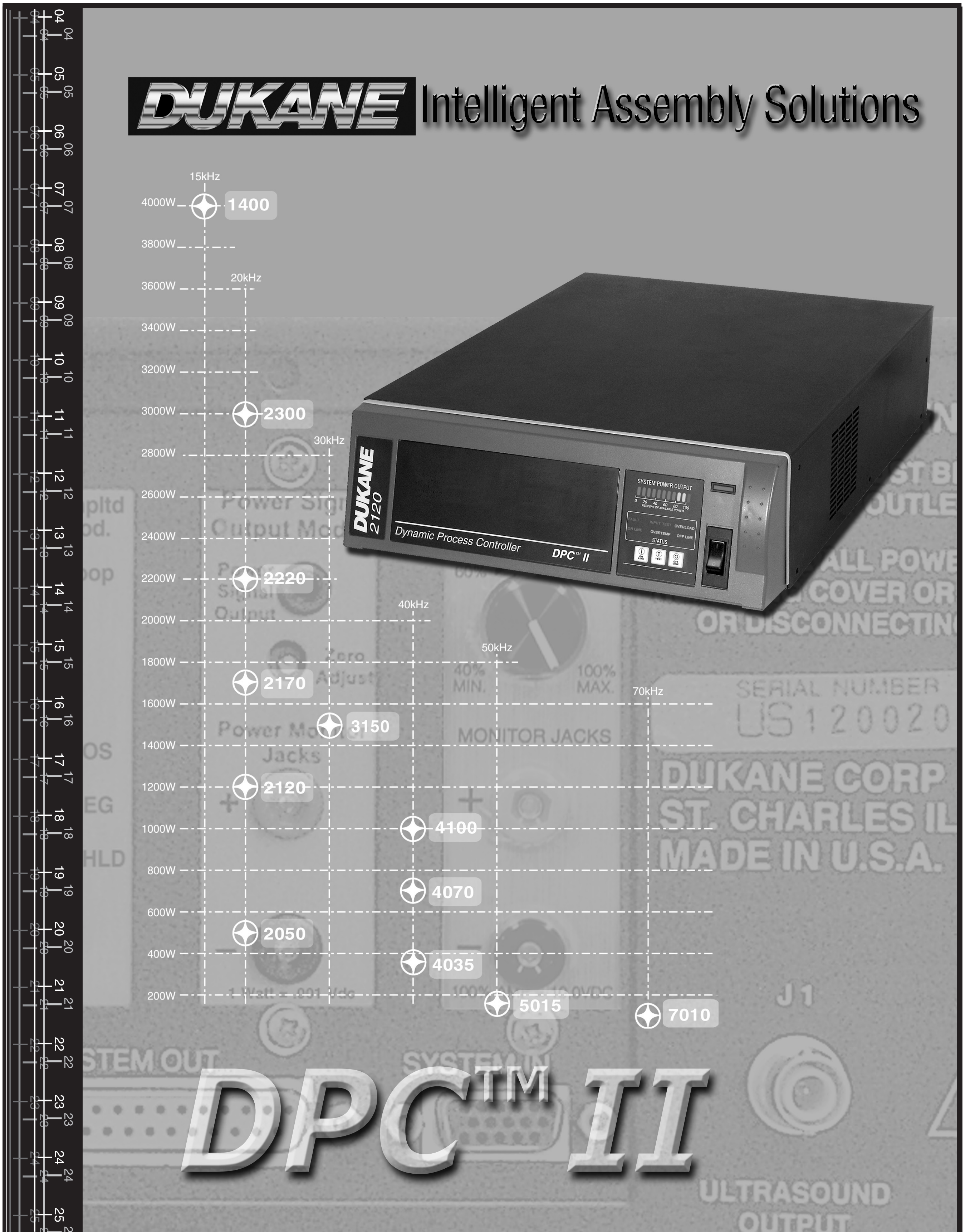


User's Manual

Dukane Part No. 403-558-03

Dukane Corporation • Ultrasonics Division • 2900 Dukane Drive • St. Charles, Illinois 60174 USA • TEL (630) 797-4900 • FAX (630) 797-4949

ISO 9001:2000 Dukane products are manufactured in ISO registered facilities

www.dukane.com/us

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Printed in the United States of America.

Dukane Part Number: 403–558–03

Dukane ultrasonic equipment is manufactured under one or more of the following U.S. Patents:
3,780,926 3,825,481 4,131,505 4,277,710 5,798,599 and 5,880,580.

DPC™ is a trademark of Dukane Corporation

DPC–2 Manual Revision History

Revision Number	Revision History	Date
–00	Original Release	2001–Mar–20
–01	Update Rev–1 Motherboard Changes	2002–Dec–14
–02	Update AC Power Reqm'ts in Table 11—I Add Figure 5–13 Press Board Cycle Activation Jumper Block on p. 50 Elaborate NOTE for setting Manual Amplitude on p. 46 Update TOC, Appendix A and Index	2005–Apr–22
–03	Removed "(Do not clamp)' on Figure 5-16 on page 65.	2005-Nov-29
	Updated website name, and Regulatory Compliance Info.	2010-May-17

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Table of Contents

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Introduction

- General Information
- Manual Organization
- DPC–II Overview
- Key DPC–II Features

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Important User Information

Read This Manual First

Before operating the DPC™ II, read this User's Manual to become familiar with the system. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate an ultrasonic system. The examples given are chosen for their simplicity to illustrate basic setup procedures.

Notes and Tips

Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the product. A NOTE block is shown to the right.

Cautions and Warnings

In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or a hand protection issue.

Drawings and Tables

The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use arabic sequence numbers (e.g. –1, –2, –3) while the tables use roman sequence numerals (e.g. –I, –II, –III). As an example, Figure 3–2 would be the second illustration in section three while Table 3—II would be the second table in section three.

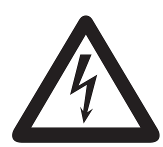
NOTE
NOTE statements provide additional information or highlight procedures.

CAUTION
CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

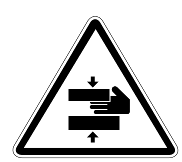
WARNING
WARNING statements point out conditions or practices that could result in personal injury or loss of life.



Condition or Practice



Electrical Hazard



Hand Hazard

Manual Organization

Section 1 – Introduction describes the manual organization and the key features of the Dukane DPC™ (Dynamic Process Controller) II Generator.

Section 2 – Safety discusses health, safety, grounding and RFI considerations.

Section 3 – Unpacking and Installation explains the DPC II placement and setup. It also shows the cable connections for quick–start operation.

Section 4 – Controls & Displays describes the function of the front panel control keys and status display.

Section 5 – Connectors gives the function, pinout and signal description of the rear panel connectors on the DPC II . Operation of the optional modules is described in detail. The difference in the motherboard revisions is identified along with internal jumper blocks to control process automation.

Section 6 – Hand Probe and Stack Assembly describes the assembly and mounting of both hand probes and probe stack assemblies.

Section 7 – System Checkout describes basic system tests to ensure that the DPC II is functioning properly.

Section 8 – Troubleshooting provides helpful tips on solving the most common problems.

Section 9 – Maintenance lists a schedule of suggested preventive maintenance items.

Section 10 – Contacting Dukane provides information on contacting or obtaining support from your Dukane Ultrasonics team.

Section 11 – Specifications lists the DPC II dimensions, power and space requirements. It also interprets the model number coding.

Section 12 – Warranty contains a copy of our equipment warranty and tooling warranty.

Appendices

A – **List of Figures.**

B – **List of Tables**.

C – **Sample Circuitry** for user supplied automation.

DPC II Overview

The DPC™ II is the lowest–cost expandable probe system in Dukane's Dynamic Process Controller product family. This system is designed for use with ultrasonic applications that require use of automated thruster systems or hand probes.

The DPC II generator provides basic system control inputs and system monitor and status outputs. This makes the DPC II ideal for automated control systems applications. Signal conditioning and electrical isolation are also provided.

The DPC II includes the same internal ultrasonic generator circuitry and reliability as the other members of the DPC generator family. Optional modules are available to enhance the DPC's ability to meet a variety of process requirements. The most common options include Amplitude control modules, a Power Signal Output module and up to two Multi–Probe controller boards for multiple probe systems. In most cases, DPC II systems in the field can be upgraded on-site

Like the other DPC models, all DPC II units (except the highest power models) feature a universal power supply with dual line–voltage input ①. In addition, the generator is designed and tested to comply with the FCC and CE regulations that apply to this product.

① See Table 11—I

DPC II Key Features

- **Dual Line–Voltage** ① **Universal Power Supply** means that the DPC II will operate worldwide. Auto-Ranging means that adjustments by the operator related to power input are unnecessary.
- **Line Voltage Regulation** automatically maintains a constant output regardless of line voltage deviation. ②
- **Load Regulation** provides constant amplitude automatically up to the rated overload power level.
- **Pulse Width Modulation** is Dukane's patented circuitry that allows the DPC power supply to efficiently control the voltage sent to the transducer in the acoustic stack.
- **Linear Ramp Softstart** circuitry is provided allowing the acoustic stack to be brought to operating amplitude smoothly, minimizing the startup shock stress.
- **Auto-Trac Tuning** automatically tracks the resonant frequency of the acoustic stack (horn, booster, transducer), and adjusts the generator output frequency to match it. ②
- **System Connections** are provided for automation equipment to monitor and control the ultrasonic welding process.
- **Modular Design** simplifies upgrades and increases flexibility as your application requirements change.
- **Flow Through Cooling Tunnel** with a matched high–performance heatsink and thermostatically controlled fan reduces thermal gradients and increases component life.
- **Electronic Overload** protection prevent component failure.

(continued on next page)

① See Table 11—I

② Within specified ranges

- **Multi–Point Control Module** option permits one DPC to handle up to eight probes in an automation environment (DPC II or DPC II Plus).
- **Press Board** option provides control for a Dukane ultrasonic press and thruster.
- **CE Certification** means that the DPC II meets the required European standards to be sold and used in Europe.
- **ISO 9001 Certification** means that the DPC II is manufactured to very high quality standards and assures you of Dukane's commitment to being a quality vendor and its goal of continuous improvement.

SECTION 2

Safety Tips

- Health & Safety
- RFI Considerations

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Health and Safety Tips

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your equipment. In this manual, the term *system* refers to a complete group of components associated with the welding of plastic or metal parts, also known as an *ultrasonic assembly system*. A typical system consists of a generator and/or ultrasonic process controller, start and stop switches, power controls, connecting cables, and the probe assembly which includes the transducer, booster, horn and replaceable horn tip.

Proper Installation – Operate system components only after they are properly installed and checked.

No Unauthorized Modifications – Do not modify your system in any way unless authorized to do so by Dukane Corporation. Unauthorized modifications may cause injury to the operator and/or equipment damage. In addition, unauthorized modifications will void the equipment warranty.

Keep the Cover On – Do not remove the equipment cover during operation. The generator produces hazardous electrical voltages which could cause injury.

Grounded Electrical Power – Operate this equipment only with a properly grounded electrical connection. (See Electrical Safety Grounding Instructions on the next page).

Comply with Regulations – You may be required to add accessories to bring the system into compliance with applicable OSHA regulations.

IMPORTANT

Never operate the DPC II with the cover off. This is an unsafe practice and may cause injury.

CAUTION

Parts being joined ultrasonically sometimes vibrate at audible frequencies. Wear ear protection to reduce annoying or uncomfortable sounds. In addition, sound absorbing materials, enclosures or sound deflectors may be installed to reduce the noise level.

Plastics Health Notice

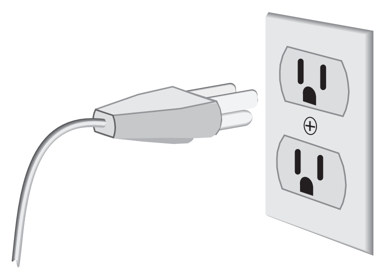
Before using any Dukane ultrasonic welding system, be sure you are familiar with OSHA regulations from the U.S. Department of Labor about the particular type of plastic(s) you are using.

When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous.

Make sure there is proper ventilation whenever these plastics are processed.

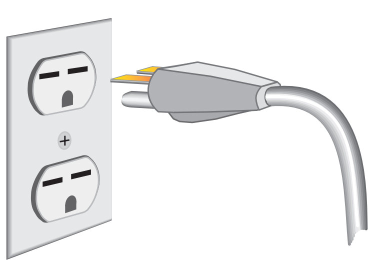
Electrical Safety Grounding Instructions

For safety, the power cords used on all Dukane products have a three-prong, grounding-type



Approved 2 pole, 3 wire grounding receptacle BRYANT No. 5621 or equivalent to NEMA 5–15R or 5–20R

Figure 2-1 Example of 120 Volt, Grounded, 3-Prong Receptacle



Approved 2 pole, 3 wire grounding receptacle HUBBELL No. 5652 or equivalent to NEMA 6–15R or 6–20R

Figure 2-2 Example of 220 Volt, Grounded, 3-Prong Receptacle

CAUTION

If you must have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. Have a qualified electrician replace it following the National Electric Code and any local codes and ordinances that apply.
See Figures 2-1 and 2-2.

CAUTION

If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The cord should have an adequate power rating to do the job safely. It must be plugged into a grounded receptacle. Do not use a two-wire extension cord with this product.

The power cable normally provided for international use is compatible with many power outlets (refer to Figure 2-3.) However, if your application requires another type of cable, check with the local Dukane products representative, and follow local regulations concerning proper wiring and grounding.

RFI Considerations

In addition to the safety considerations, proper grounding at the generator power cord is essential for the effective suppression of RFI (Radio Frequency Interference). Every DPC contains a RFI filter which blocks noise on the AC power line from entering the DPC control circuitry. This filter also prevents ultrasonic RFI from being fed back into the AC power line. In order for the RFI filter to operate properly, it is necessary to adequately ground the DPC. Run an additional grounding wire from the rear grounding connection (see Figure 2-4) to the nearest grounded metal pipe or equivalent earth ground by means of a ground clamp. Use at least an 14 AWG ③ wire for the connection to the DPC chassis. Stranded is more flexible and easier to work with than solid wire. However if you use stranded wire, crimp spade lugs on the end to ensure a good connection. If you have a color choice, green is the commonly accepted color for an electrical ground connection.

③ 14 AWG wire has a diameter of 1.63mm or

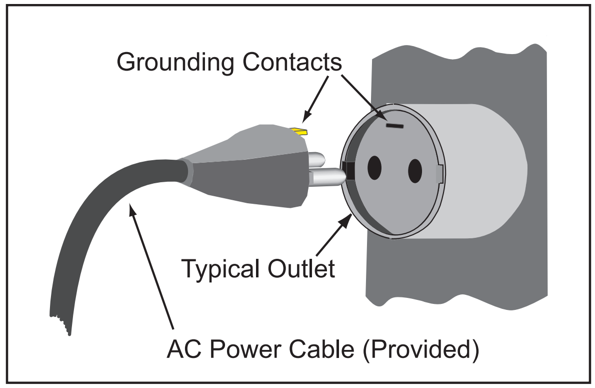


Figure 2-3 International 220/240V Grounding

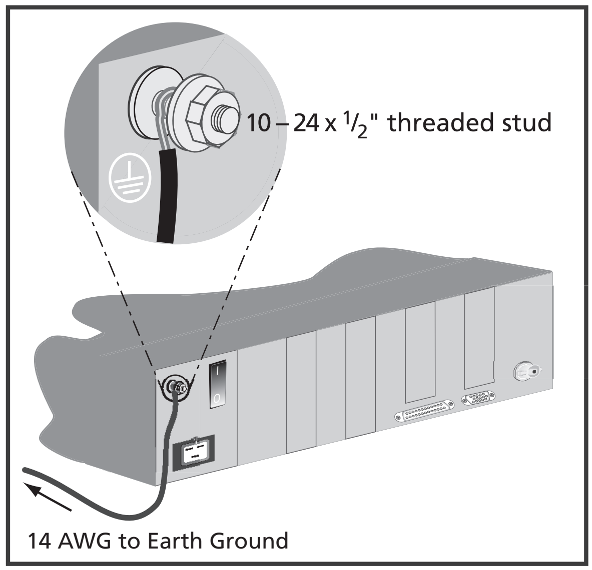


Figure 2-4 DPC Grounding Arrangement

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Unpacking & Installation

- Unpacking the DPC
- Placement of the DPC
- Rear Panel Overview
- Grounding the System
- Connecting the Cables

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Shipping Contents

Quantity	Item	Part Number
1	DPC II	**
1	DPC II User's Manual	403–558–xx
** DPC Part Number depends upon Frequency and Power Rating AC power cord and cables as specified. See your Packing List. Compare with Table **3-II** on page 21.		

Table 3—I DPC II Shipping Container Contents

Carefully open the shipping container, and make sure it contains the items shown in Table 3–I. Inspect the DPC for damage. Report any damage immediately to Dukane Ultrasonics Support/Service.

DPC Placement

Placement of the DPC depends on whether it is a benchtop or rack-mounted configuration

Benchtop

Place the DPC on a flat surface with its front panel easily accessible. Make certain the placement and cabling do not interfere with the assembly operation.

Allow 4 inches (10 cm) at the rear of the DPC for cable clearance. Allow 2 inches (5 cm) of space on either side of the DPC for air circulation. Refer to the illustration in Figure 3-1.

CAUTION

Allow space for air ventilation around the DPC II chassis, the air intake and exhaust. The fan draws in fresh air to cool the internal components, reduce thermal gradients and increase component life. When viewed from the front, the fresh air intake is on the right and the hot air exhaust is on the left side.

If excessive dust accumulates in the slots, wipe or vacuum them clean. Do not use compressed air as this may force the dust inside the chassis.

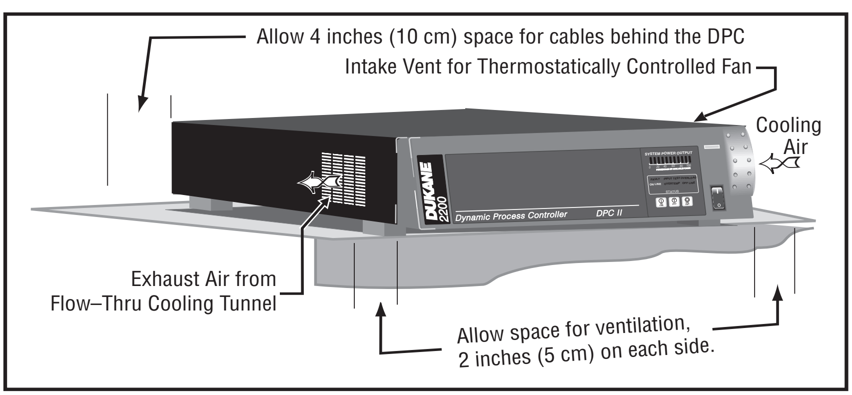


Figure 3-1 DPC Benchtop Installation

Rack Mounting

Figure 3-2 shows the use of a bracket kit in mounting a DPC to a 19-inch equipment rack. (Contact Ultrasonic Sales at Dukane, and request Part Number US-1155.) The DPC illustrated has the standard, angled front panel of impact-resistant ABS plastic.

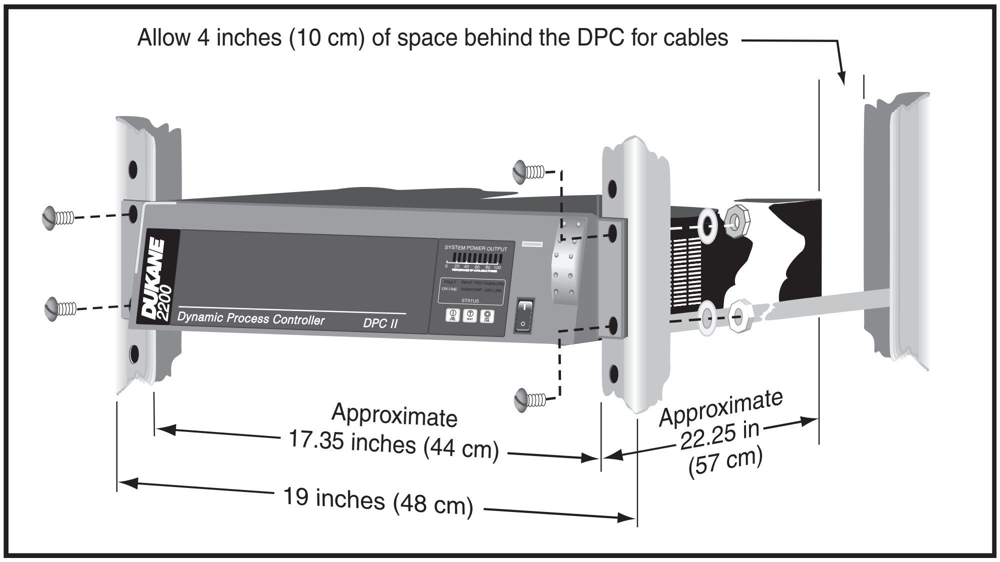


Figure 3-2 DPC Rack Mount Installation Using Bracket Kit

CAUTION

Allow 2 inches on either side of the DPC II chassis for air ventilation. The fan draws in fresh air to cool the internal components, reduce thermal gradients and increase component life. When viewed from the front, the fresh air intake is on the right and the hot air exhaust is on the left side.

If excessive dust accumulates in the slots, wipe or vacuum them clean. Do not use compressed air as this may force the dust inside the chassis.

Rear Panel Overview

Familiarize yourself with the connection points for power, ground, ultrasound output, system I/O and the optional modules on the rear of the DPC II shown below in Figure 3–3. The standard connectors are labeled with the black boxes. The optional modules are labeled with italics. The grounding lug, serial number tag, rear AC power switch and AC power input are located in the same position on all DPC II, DPC II Plus, DPC III and DPC IV generators.

> **NOTE**
> Not all of the optional modules illustrated below can be installed simultaneously. They are shown to represent the various configurations that can be assembled to meet specific requirements. See Section 5 for more detailed information on the modules, their functions and capabilities.

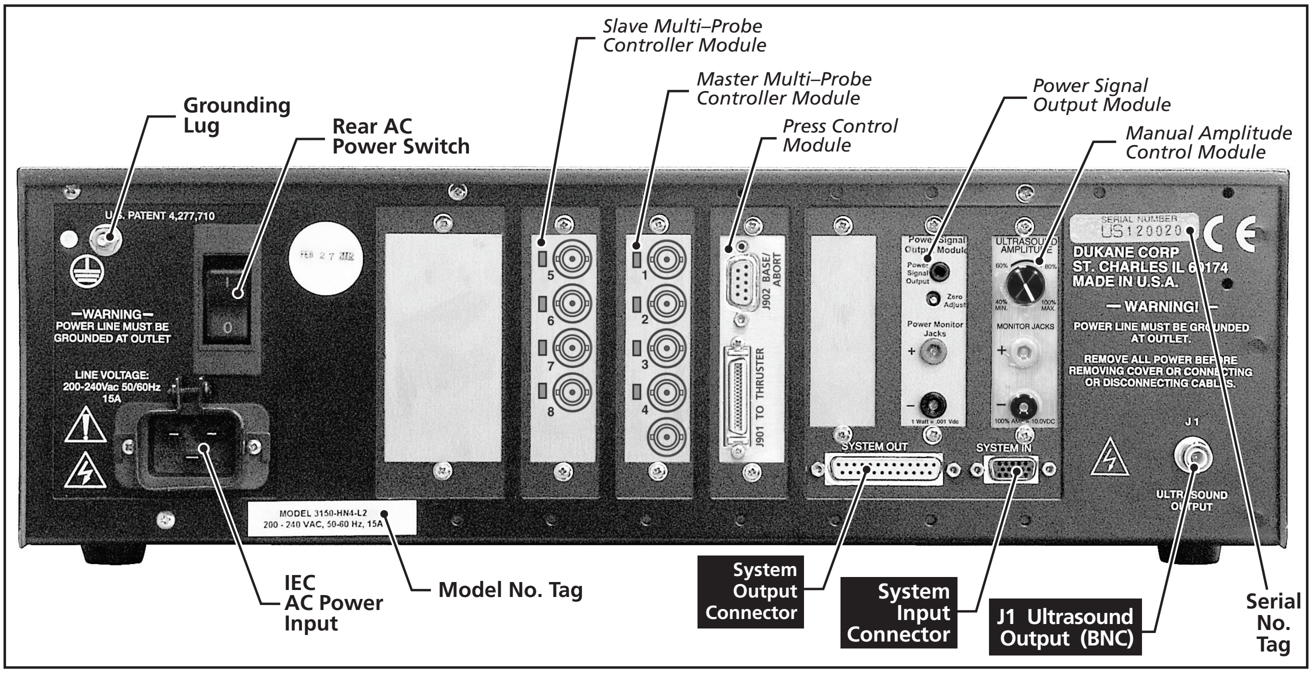


Figure 3-3 Rev–1 DPC II Rear Panel and Optional Modules

Ground the System

The DPC II includes an internal RFI filter. The standard building AC ground connection is normally not sufficient to completely suppress the RFI. Attach a ground cable from the DPC grounding lug (located next to the rear AC power switch) to an earth ground. If you are using a press or automated probe system, each piece of equipment must also be solidly grounded. Refer to Figures 3–4 through 3–8 for the proper ground-

> **CAUTION**
> Before attaching the cables, make sure that the DPC II is properly grounded. Refer to the appropriate cabling diagram (Figures 3–4 thru 3–8) for the correct grounding connections.

Connect the Cables

The instructions here and the diagrams in Figures 3–4 through 3–7 are meant to serve as a quick start guide. The connectors and their pinouts are discussed in greater detail in Section 5.

Manual Probe System

Step 1. Ground the DPC II chassis.

Step 2. Attach the System In adapter cable (see Figure 3–4) to the 14-pin AMP connector at the end of the probe cable.

Step 3. Connect the other end of the adapter to the System In HD-15 connector on the rear of the DPC II.

Step 4. Attach the high voltage ultrasound coaxial cable to the rear-panel J1 connector.

Step 5. *Optional – If your system has a Press Control Module, you will also need a jumper block (Part No. 200-1293) to replace the normally closed contact from the Emergency Stop safety switch.*

Step 6. Attach the power cord to the DPC II and plug the other end into an approved AC outlet.

Automated Probe System

Step 1. Ground the DPC II chassis and the probe support.

Step 2. Attach the high voltage coax cable from the probe mount to the rear-panel DPC connector J1 (see Figure 3–5).

Step 3. Connect the automation control cable from the user–supplied automation equipment to the System Input rear panel HD-15 connector (Figure 3–5).

CAUTION

Make sure electrical power is OFF before connecting/disconnecting cables or installing/removing modules from the DPC II. Make sure BOTH the front and rear panel AC power breaker switches are in the OFF position. Failure to turn off the power may result in damage to the DPC and/or the modules.

CAUTION

The power cord is equipped with a three-prong, grounded-type plug for your safety. Whenever a two-slot receptacle is encountered, we strongly recommend that it be replaced with a properly grounded three-lead receptacle. Have a qualified electrician perform the installation in accordance with the National Electrical Code and local codes and ordinances. **DO NOT** cut off the AC power cord grounding prong or alter the plug in any way.

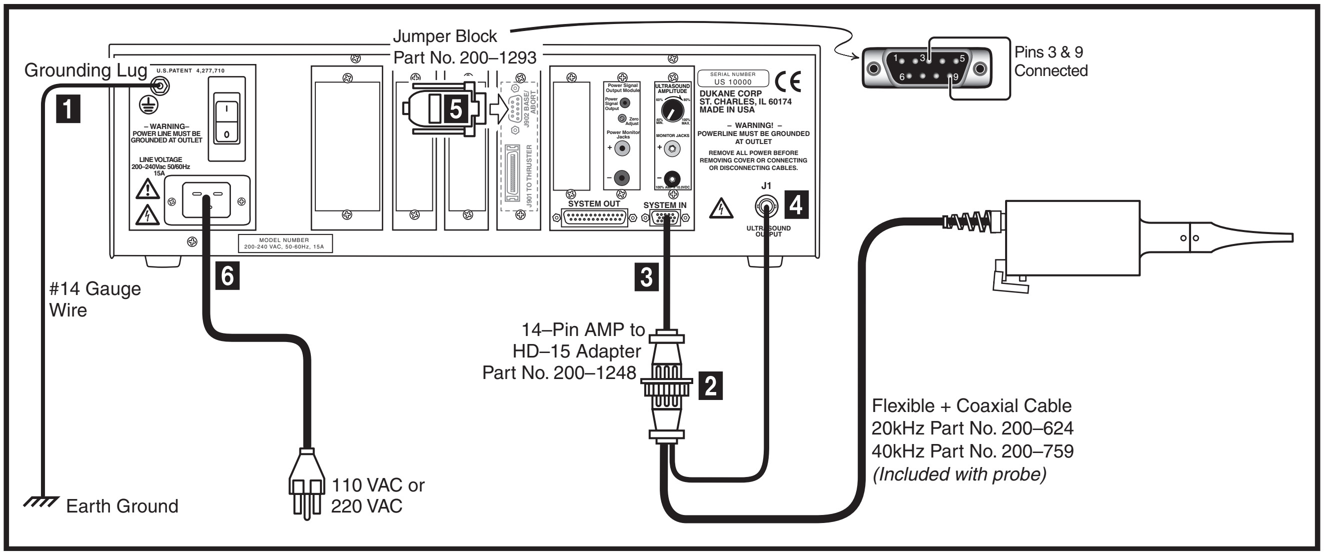


Figure 3-4 DPC II Hand Probe Cable Connections

Step 4. *Optional – Attach the status output cable from the user–supplied automation equipment to the System Output DB-25 connector. Not all automation systems will have this cable.*

Step 5. Attach the power cord to the DPC II and plug the other end into an approved AC outlet.

The 3–prong AC Line cords supplied are matched to the DPC II power rating and the continent of specified use.
The part numbers are —

200–1109	North America 110V
200–1110	North America 220V
200–1111	Continental Europe

Table 3—II DPC II AC Power Cord Part Numbers

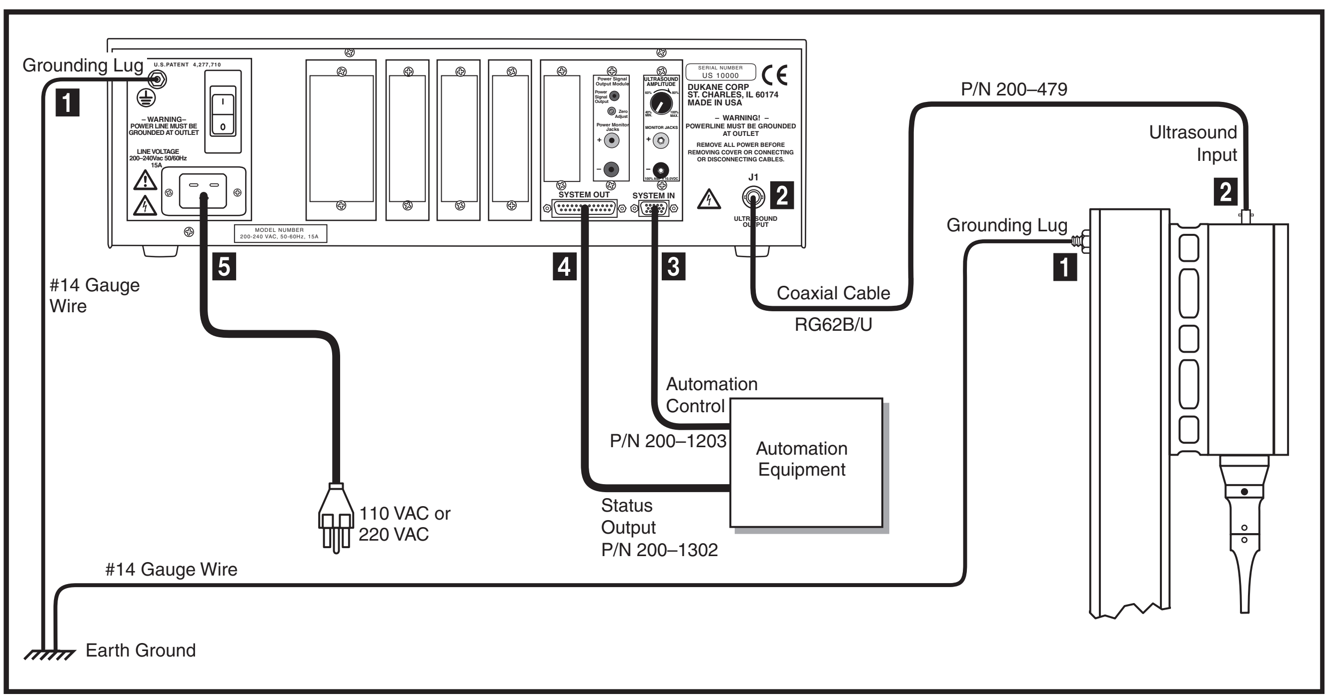


Figure 3-5 DPC II Automated Probe Cable Connections

Multiple Probe System

Step 1. Ground the DPC II chassis and the probe support.

Step 2. Attach the short coaxial cable from the rear-panel DPC generator U/S output J1 (see Figure 3–6) to the MPC U/S input (supplied with the Master MPC).

Step 3. Attach another high voltage coax cable from the rear MPC channel 1 probe output to the first probe. Attach a separate cable from each output channel to each probe.

Step 4. Connect the automation control cable from the user–supplied automation equipment to the System Input rear panel HD-15 connector.

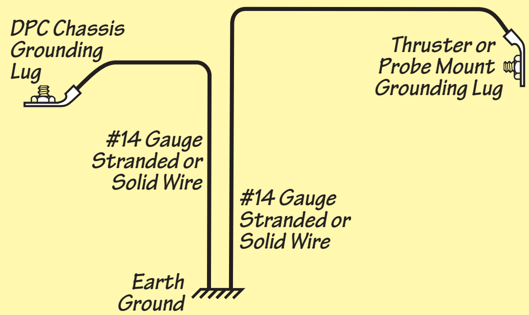
Step 5. Attach the status output cable from the user–supplied automation equipment to the System Output DB-25 connector.

Step 6. Attach the power cord to the DPC II and plug the other end into an approved AC outlet.

CAUTION

To ensure safe and trouble–free operation, ground the DPC chassis and probe mount as shown in Figures 3–4 to 3–7.

Use a STAR configuration (illustrated below). Do not DAISY CHAIN the grounds.



NOTE

The automated system cabling schematics in Figures 3–5, 3–6 and 3–7 are intended to represent connections for a typical automation system. Your system cabling may vary slightly from the

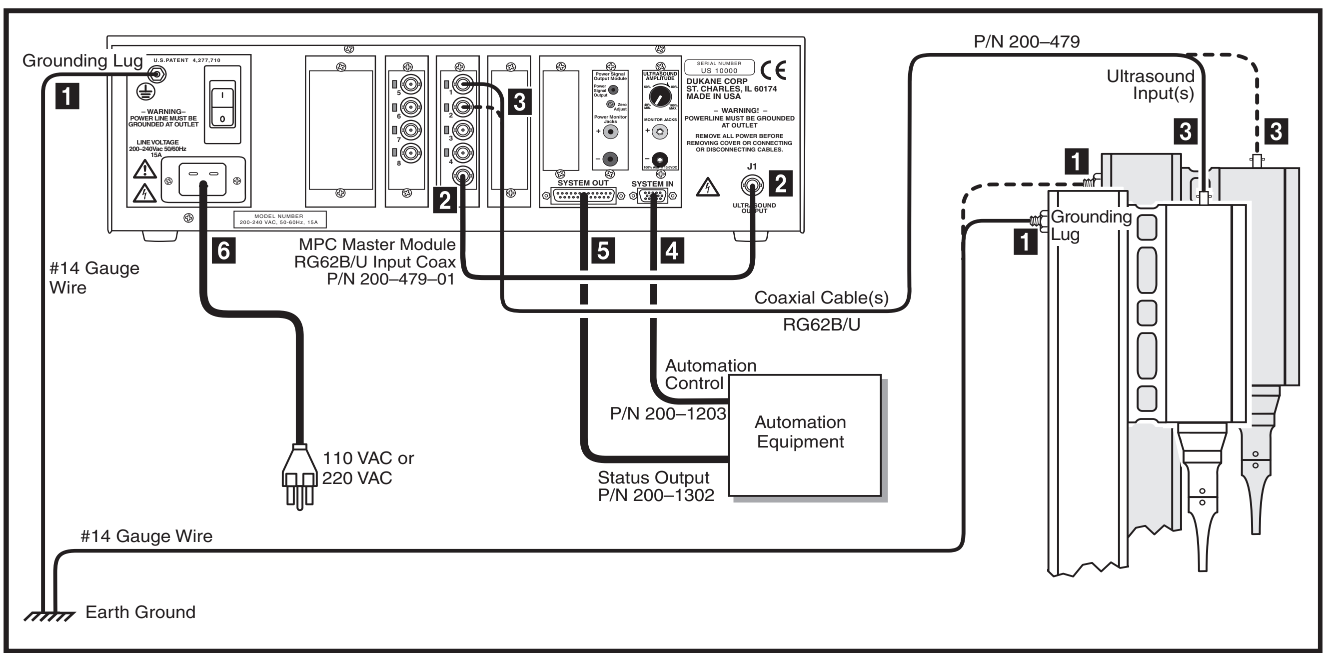


Figure 3-6 DPC II Multiple Probe Conntroller Cable Connections

Automated Thruster System

Step 1. Ground the DPC II and the Thruster as shown in Figure 3–7.

Step 2. Attach the high voltage RG62B/U coax cable from the rear-panel DPC II connector J1 to the ultrasound input J1 on the thruster (see Figure 3–7).

Step 3. Connect the Automation Control cable from the user–supplied automation equipment to the System Input rear panel HD-15 connector.

Step 4. Attach the Status Output cable from the user–supplied automation equipment to the Status Output DB-25 connector.

Step 5. Connect the Press Base Input cable from J35 on the Press Base to the DB-9 connector (J902) on the Press Control Module. If the automation system does not have a connection to J902, you may need a jumper block (Part No. 200-1293) to replace the normally closed contact from the press base Emergency Stop safety switch.

Step 6. Connect the Operational Control cable from the user–supplied automation equipment to the 36–contact Thruster control connector (J901) on the Press Control Module.

Step 7. Attach the power cord to the DPC II and plug the other end into an approved AC outlet.

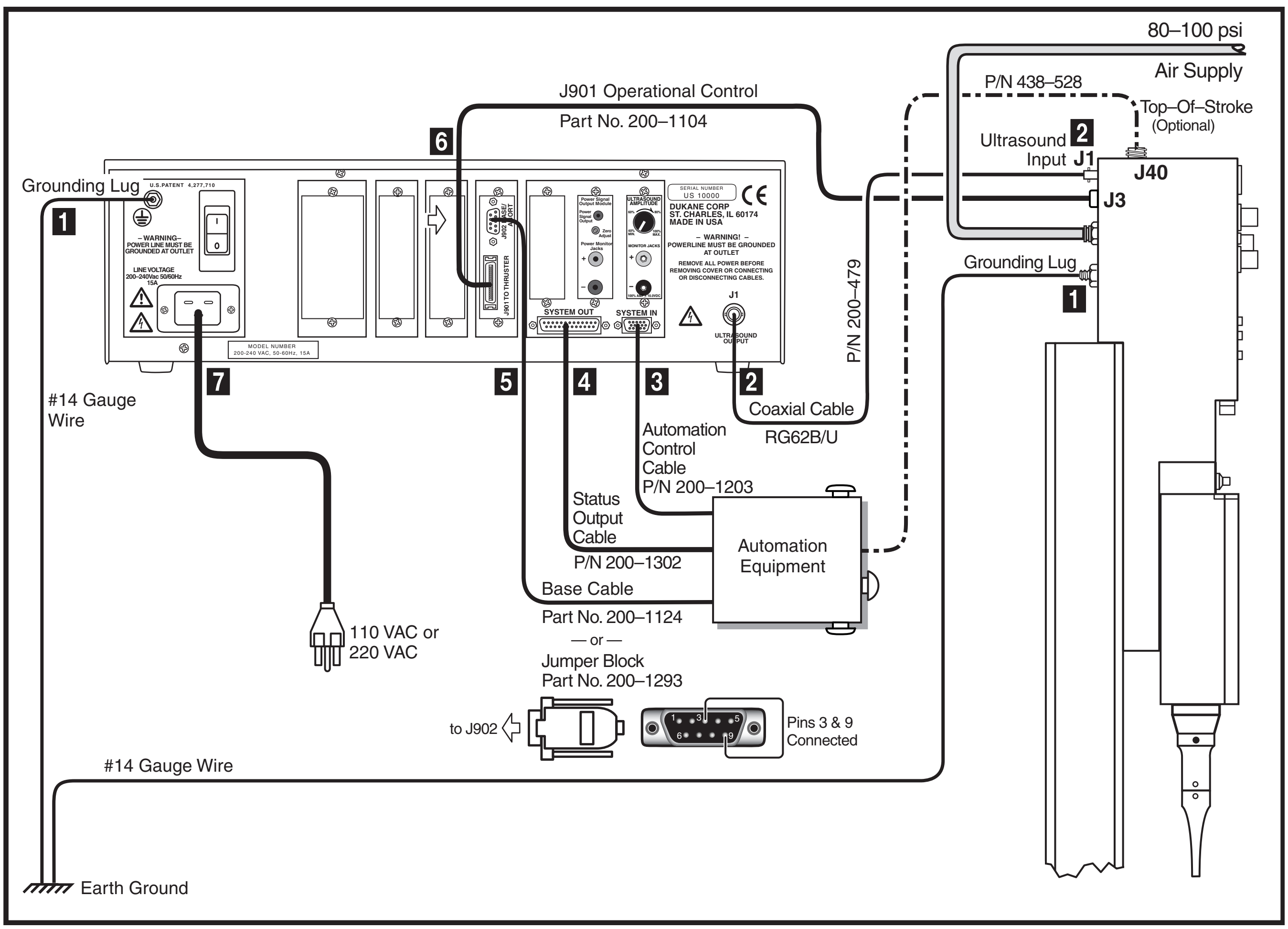


Figure 3-7 DPC II Automated Thruster Cable Connections

Dukane Press System

Step 1. Ground the DPC II, the Thruster and the Base as shown in Figure 3–8.

Step 2. Attach the high voltage coax cable from the press J1 connector to the DPC Ultrasound Out connector (J1).

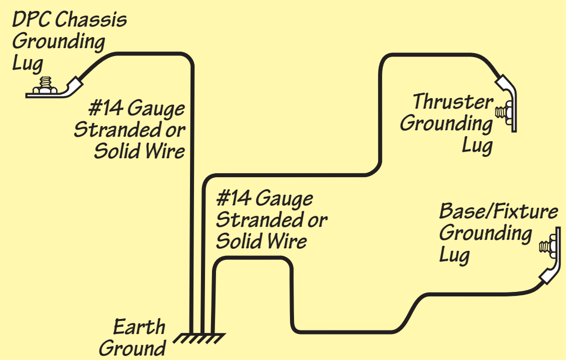
Step 3. Connect the Press Base Input cable from J35 on the Press Base to the DB-9 connector (J902) on the Press Control Module.

Step 4. Connect the Operational Control cable from J3 at the top of the press to the 36–contact Thruster control connector (J901) on the Press Control Module.

Step 5. Attach the power cord to the DPC II and plug the other end into an approved AC outlet.

CAUTION

Use the STAR configuration illustrated below and in Figure 3–8 to ground the DPC chassis, base and thruster. Do not DAISY CHAIN the grounds.



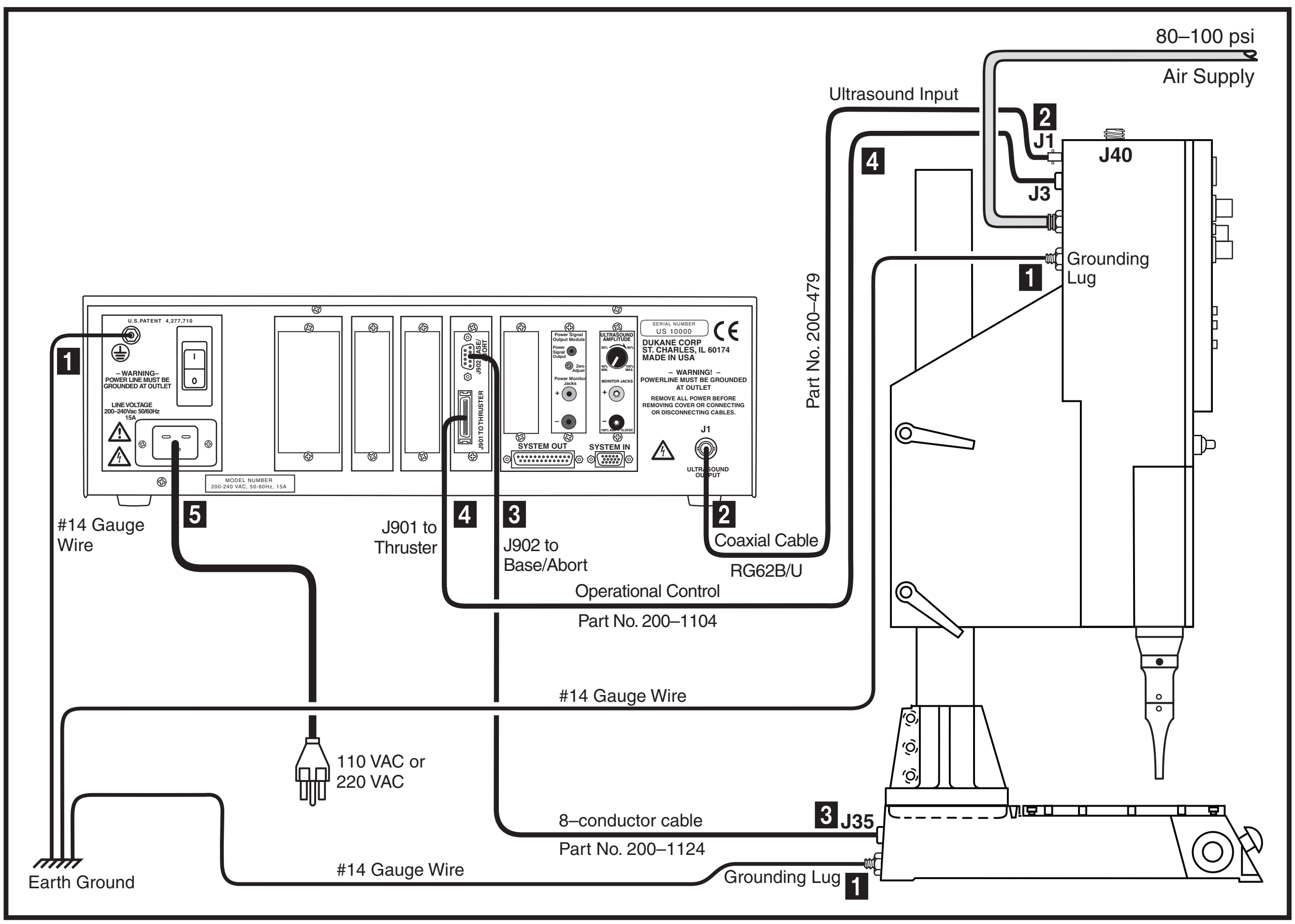


Figure 3-8 DPC II Dukane Press Cable Connections

Switch

The rear panel AC breaker switch (Figure 3–9) is wired in series with the front panel breaker switch (shown in Figure 4-2). When the rear breaker switch is off, it isolates the AC power feed in the chassis for safety considerations. Both the front panel and rear panel switches must be on to supply AC power to the DPC generator.

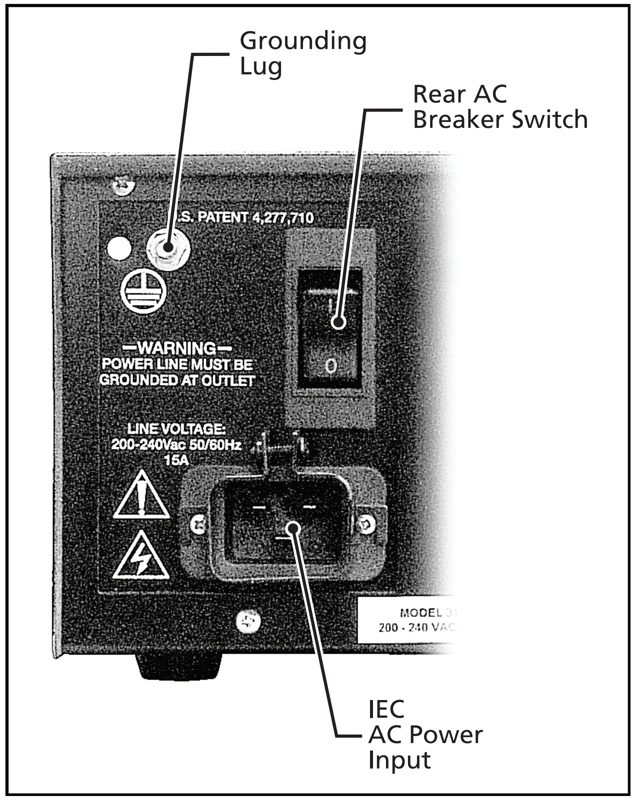


Figure 3-9 Rear Panel AC Breaker Switch

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Controls & Displays

- Front Panel Layout
- AC Power
- Generator Status

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Front Panel Layout

This section describes the DPC II front panel control keys and status displays.

The DPC front panel is laid out in two sections as illustrated below in Figure 4-1. The two sections are

1. AC Power switch and indicator Ⓐ
2. Generator Status Panel which contains
   - Three Status Control keys Ⓑ
   - System Status display Ⓒ
   - System Power Output display Ⓓ

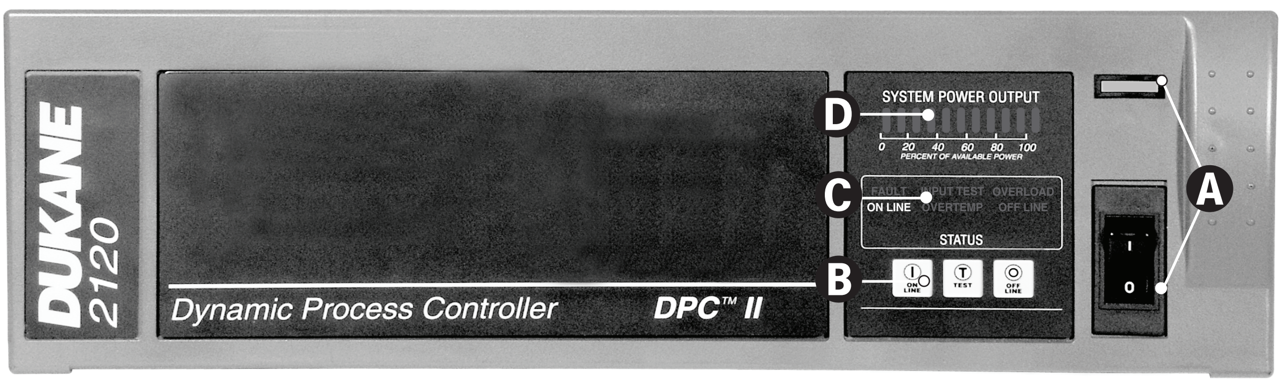


Figure 4–1 DPC II Front Panel Layout

1. AC Power Section

The front-panel AC power section has a switch and power indicator that is shown in Figure 4-2.

ON/OFF The AC power switch connects AC power to the generator. This breaker switch is wired in series with the rear panel power switch (Figure 3–9). It also serves as a circuit breaker that provides overload protection for the DPC. Both switches must be turned on to supply AC power to the generator.

Green LED The green indicator above the switch lights when the DC bus is up, after the AC power has been switched on. At this point the generator is capable of producing an ultrasonic output signal.

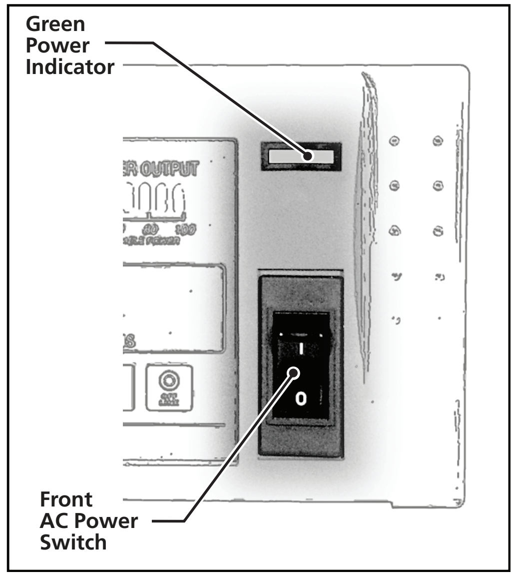


Figure 4–2 Front Panel AC Power Section

2. Generator Status Panel

The Generator Status Panel is subdivided into three sections which provide control and status displays.

1. Generator Control Keys
2. System Status Display
3. System Power Output Display

Status Control Keys

The Generator Control Key section consists of three keys as shown in Figure 4-3.

ON LINE This places the generator in an operational state. It can produce an ultrasonic output signal when triggered.

TEST The TEST key momentary activates the generator to provide ultrasound output for test or setup purposes. TEST will only work in the ON LINE state.

OFF LINE This key places the generator in a stand-by mode. This prevents the generator from producing an ultrasonic output signal.

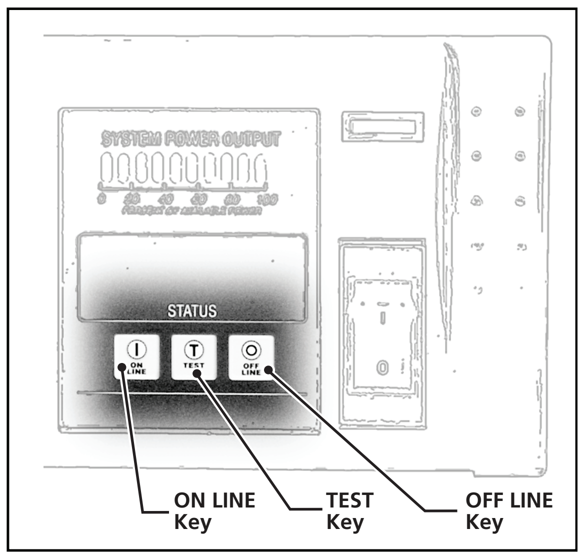


Figure 4–3 Generator Control Keys

> **NOTE**
> If a Press module is installed, these keys are only active if the Emergency Stop is not engaged. If the Emergency Stop switch is depressed, the System Status Display will not be lit and the Control Keys inactive.

System Status Display

The System Status Display indicates one of the six system states. If that state is active, the corresponding label is lit in the display. Figure 4-4 shows the System Status Display with the ON LINE state activated. The six status conditions are described here.

FAULT This indicator lights when out-of-tolerance voltage fluctuations occur that are related to one of the following conditions.

1. AC Line Voltage
2. Internal DC Power Supply (+5 VDC, +12 VDC, -12V DC or +24V DC.)

INPUT TEST This indicator normally flashes red during a power-up test. If there is a problem, a steady red light appears. This means that either the input AC line voltage is out of tolerance, or an internal fault has occurred in the generator.

OVERLOAD This red indicator lights when either of the following conditions occur.

1. An instantaneous overload caused by a mismatch between the ultrasonic signal and the resonant characteristics of the acoustic stack (transducer, booster and horn.)
2. Excessive power beyond the generator's rated output is being drawn.

ON LINE The generator is capable of operation.

OVERTEMP One of the power modules has overheated and the generator has shut down. This may be caused by excessive dust in the cooling channel or a cooling fan failure. The generator will automatically reset when the module temperature drops below the trip point which is 75°C (167°F).

OFF LINE The generator is in a standby mode. The ultrasound output cannot be activated.

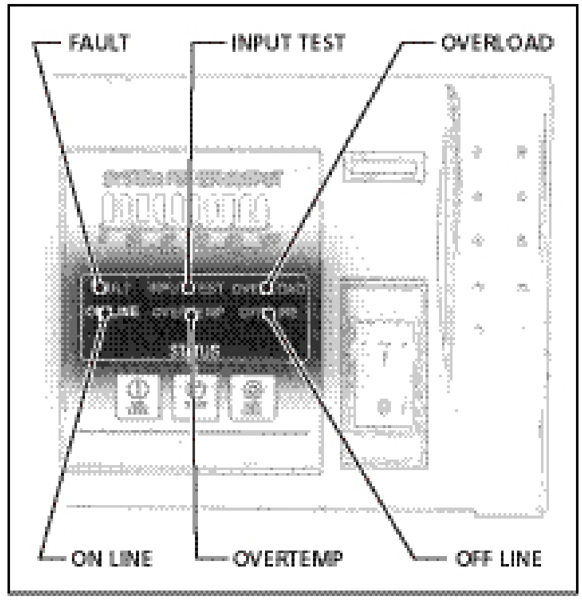


Figure 4–4 System Status Display

System Power Output Display

The tricolor System Power Output Display indicates the percentage of ultrasonic power being drawn by the load.

Green Eight green vertical bars indicating 10% to 80% power output are displayed during normal operation. Figure 4-5 shows the display indicating 80% output power.

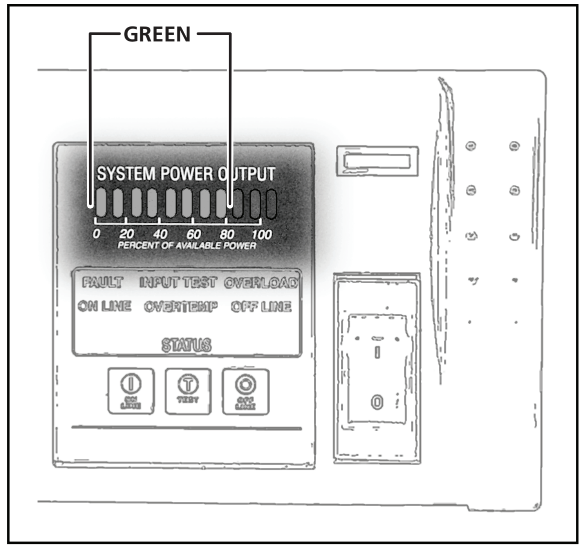


Figure 4–5 Normal Operation

Yellow Two yellow bars for 90% and 100% power output warn that the generator is operating near its maximum rated output.

Red The last red bar indicates that the generator is in an overload condition delivering more than its rated output power. Figure 4-6 shows the red overload and two yellow warning indicators. The red warning indicator lights up just prior to an overload condition. The ultrasonic signal is shut down when an overload condition occurs.

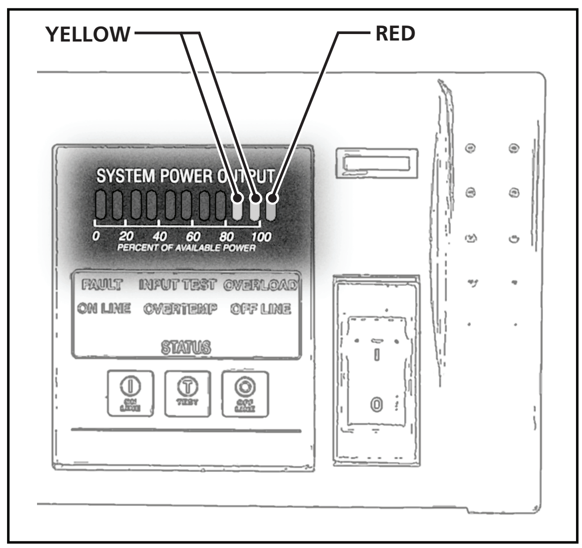


Figure 4–6 Warning Indicators

SECTION 5

Rear Connectors

- Rear Panel Layout
- System Control Inputs
- System Status Outputs
- Optional Modules
- Internal Jumper Blocks
- Motherboard Layouts

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Rear Panel Layout

The DPC II has been built using two different motherboard designs. The original DPC II model used the DPC II board (Rev–0). The later DPC II models utilize the same motherboard as the DPC II Plus (Rev–1). Figure 5–1 shows the rear connectors and the optional modules installed into a DPC II which has the Rev–1 motherboard. No generator can have all the modules shown. Specifically the Multi–Probe Controller and the Press Control Modules are mutually exclusive. The modules are shown here to indicate their installed locations and connector types. Figure 5–2 shows the rear connectors and the optional modules installed into a DPC II which has a Rev–0 motherboard. Figure 5–3 identifies the major differences between the

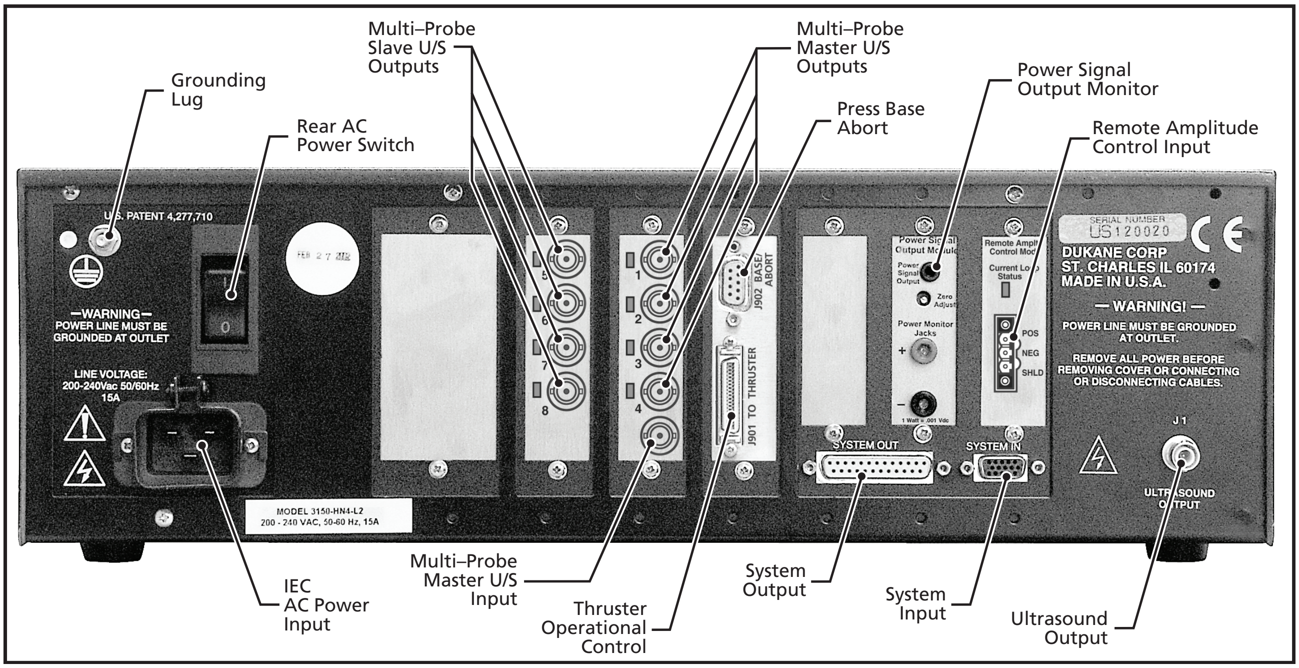


Figure 5–1 DPC II (Rev–1 Motherboard) Rear Panel Connectors and Optional Modules

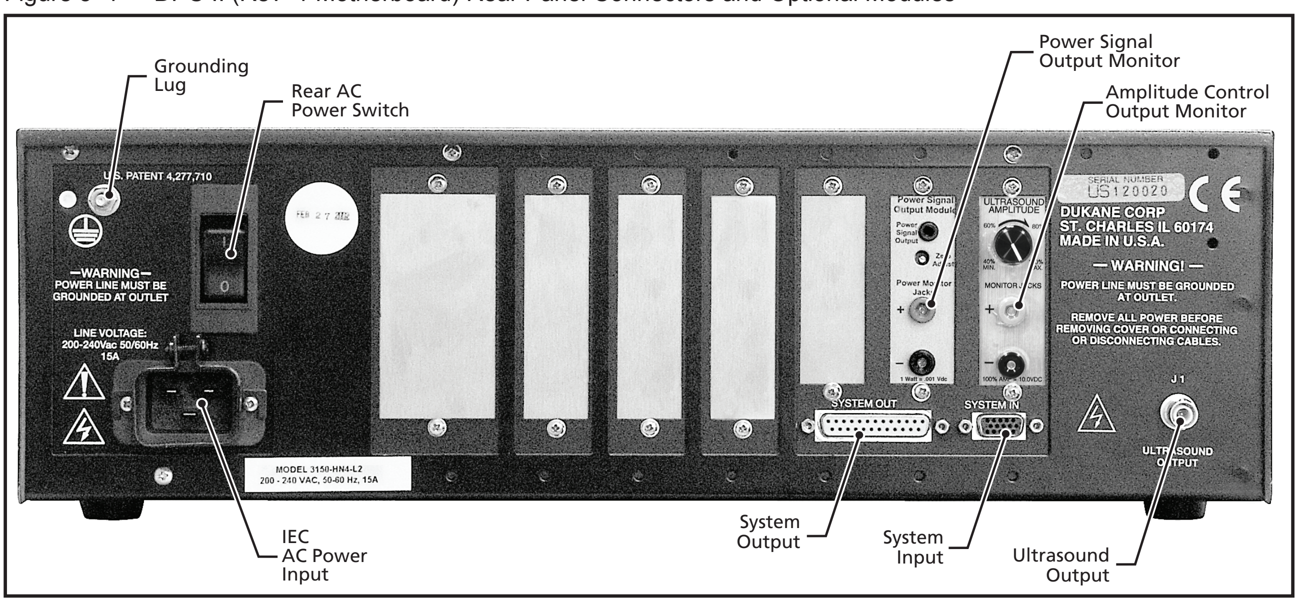


Figure 5–2 DPC II (Rev–0 Motherboard) Rear Panel Connectors and Optional Modules

DPC II Motherboards

There is no operational or performance difference between the two designs of motherboards except for the pinout of the System Input connector and the optional modules the DPC II will accept. Figure 5–3 below shows the main identifying features of the Rev–0 and Rev–1 motherboards as seen with the DPC II chassis cover removed. The rear panel connectors (J701 and J702) are at the bottom of the drawing.

WARNING

Never operate the DPC II with the cover off. The generator produces hazardous electrical voltages which could cause injury.

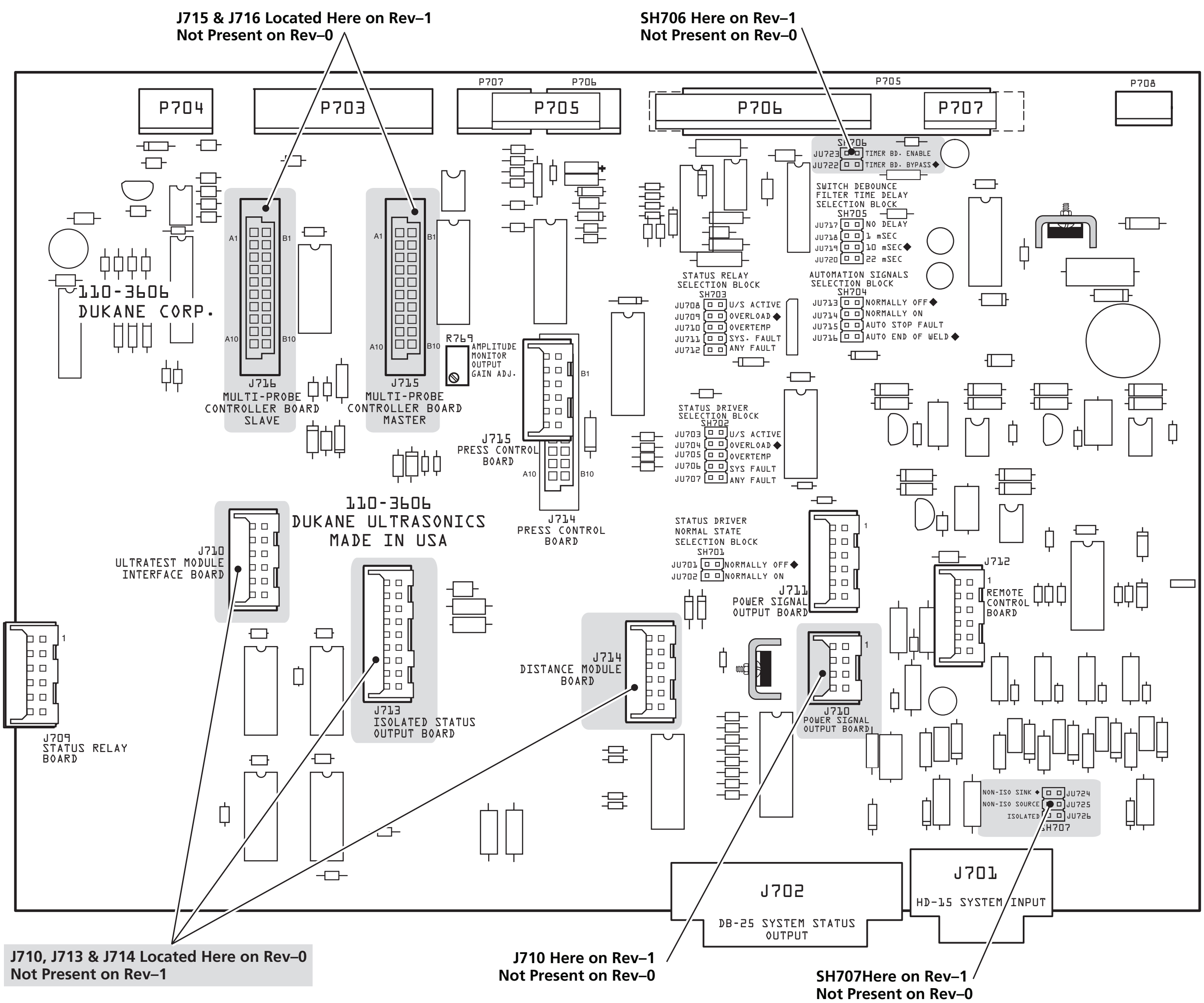
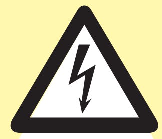


Figure 5–3 Identifying Characteristics of Rev–0 and Rev–1 DPC II Motherboards

System Input Connector Rev–1

The System Input is a HD-15 (high-density, 15 contact) female connector. Pin numbers are identified in Figure 5–4. Table 5—IA below lists the pinout and signal names of the System Input connector for a DPC II with a Rev–1 motherboard. A complete description of the input signals and their function is given on the next page. Users of custom automation will also find a list of wire color codes for the automation cable assembly (Dukane Part 200–1203) in Table 5—III. This cable is used to connect the DPC to custom automation equipment



CAUTION

The System Input port uses the same type of connector as a standard computer video monitor port, but it is electrically very different. DO NOT connect any video monitor devices to this connector. Doing so may result in damage to both the video device and the DPC.

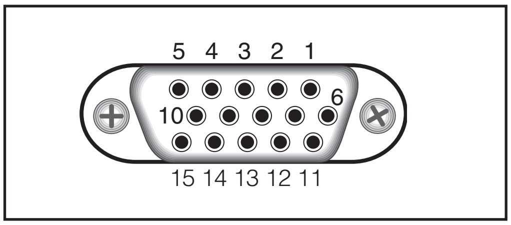


Figure 5–4 HD-15F System Input Connector

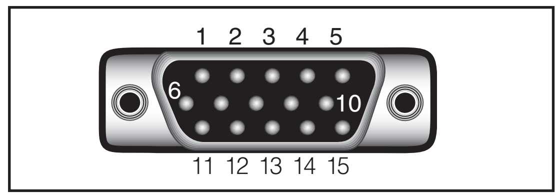


Figure 5–5 Cable end of SYSTEM IN connector.

Pin	Signal Name	Signal Description
1	+22VDC	Current limited to 250 mA maximum
2	Gnd	22VDC Return (DPC Chassis Ground)
3	Iso Oper In	Isolated Operate Input
4	Iso Common	Isolated Input Common (if jumper is selected – Figure 5–9/SH707)
5	Iso Press Cntrl	Isolated Press Control
6	Not Used	Spare Input Pin
7	Gnd	22VDC Return (DPC Chassis Ground)
8	Sw Oper Input	Switch Closure Operate Input
9	Iso Auto Stop	Isolated Automation Stop Input —OR— Isolated Automation End–Of–Weld (set by jumper SH704 see Figure 5–15)
10	Not Used	Reserved for Future Use
11	HPPI	Hand Probe Press Inhibit
12	Probe I.D. Bit 0	Probe Selection Bit #0 (LSB)
13	Probe I.D. Bit 1	Probe Selection Bit #1
14	Probe I.D. Bit 2	Probe Selection Bit #2 (MSB)
15	F P Lock	Front Panel Control Lock

Table 5—IA Rev–1 Motherboard System Input Connector Signals

Rev–1

NOTE

The connector pinout in Figure 5–4 is the female DPC panel connector. The male cable end is a mirror image and is shown in Figure 5–5.

Pin 14	Pin 13	Pin 12	MPC Probe Selected
0	0	0	Probe 1
0	0	1	Probe 2
0	1	0	Probe 3
0	1	1	Probe 4
1	0	0	Probe 5
1	0	1	Probe 6
1	1	0	Probe 7
1	1	1	Probe 8

Note: 1 = Pin Grounded (to DPC chassis)
0 = Pin Open (no connection)
Probe 1 is the default selection

Table 5—II Remote Probe Selection

Input Signal Description

Pin 1 (+22V)

This pin can supply +22VDC at up to 250mA to power the user's automation controls.

Pin 2 (Gnd)

Pin 2 and 7 are the 22VDC and Operate returns and are tied to the chassis ground.

Pin 3 (Isolated Operate In)

This pin is used to initiate the operate sequence. The factory default setting is a non-isolated sink requiring a dry contact closure to ground (pins 2 or 7). This input can be changed to a source or fully isolated input by jumper block SH707. See Figures 5–14, 5–15 and Appendix C.

Pin 4 (Isolated Common)

This pin is used as the isolated return common if jumper block SH707 is configured as a fully isolated input (position JU726). See Figures 5–14, 5–15 and Figure C–7.

Pin 5 (Isolated Press Control)

This input is designed to be used in conjunction with the optional Press Control Board. The signal is used to activate the thruster up and down. The factory default setting is a non-isolated sink requiring a dry contact closure to ground (pins 2 or 7). This input can be changed to a source or fully isolated input by jumper block SH707. See Figures 5–14, 5–15 and Appendix C.

Pin 6 (Not Used)

Isolated input reserved for future use.

Pin 7 (Gnd)

Pin 2 and 7 are the 22VDC and Operate returns and are tied to the chassis ground.

Pin 8 (Operate)

A dry contact closure (no voltage) between pin 8 and ground (pins 2 or 7) will initiate the operate sequence and is functionally the same as pin 3.

Pin 9 (Isolated Auto Stop)

This signal stops the operation sequence. The factory default setting is a non-isolated sink requiring a dry contact closure to ground (pins 2 or 7). This input can be changed to a source or fully isolated input by jumper block SH707. See Figures 5–14, 5–15 and Appendix C.

Pin	Color	Signal Desc	Note
1	Red	+22V	Red used by Belden may appear brown
2	Black	Gnd	Also connected to connector metal shell
3	Blue/Blk	Iso Oper In	
4	Green/Wht	Iso Common	
5	Blue/Wht	Iso Auto Cntrl	
6	Red/Blk	Reserved	Red used by Belden may appear brown
7	White/Blk	Gnd	
8	White	Sw Oper Input	
9	Orange	Iso Auto Stop	
10	Blue	Reserved	
11	Orange/Blk	Hand Probe Press Inhibit	Black may be faint – Don't confuse with 9
12	Red/Wht	Remote Probe Selection (LSB)	Red used by Belden may appear brown
13	Green/Blk	Remote Probe Selection	
14	Black/Wht	Remote Probe Selection (MSB)	
15	Green	F P Lock	

Table 5—III System Input Automation Cable Color Code (Dukane Part No. 200–1203)

Pin 10 (Not Used)

Isolated input reserved for future use.

Pin 11 (Hand Probe Press Inhibit)

The adapter cable (P/N 200–1203) has pin 11 grounded to indicate a hand probe is connected.

Pins 12, 13, 14 (Probe Selection)

When using the multi–probe controller module (MPC), these bits select which probe is activated. A dry contact closure between pins 12, 13 or 14 and ground (pins 2 or 7) will activate one of the probes. The pin combinations to select probes one through eight are given in Table 5—II.

Pin 15 (F P Lock)

A dry contact closure between pin 15 and ground (pins 2 or 7) will lock out the front panel TEST key and prevent it from being activated. This also prevents any programming changes.

System Input Connector Rev–0

The System Input is a HD-15 (high-density, 15 contact) female connector. Pin number are identified in Figure 5–4. Table 5—IB below lists the pinout and signal names of the System Input connector for a DPC II with a Rev–0 motherboard. A complete description of the input signals and their function is given on the next page.

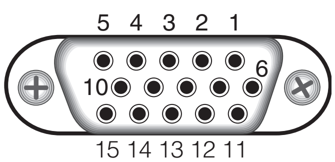


Figure 5–4 HD-15F System Input Connector

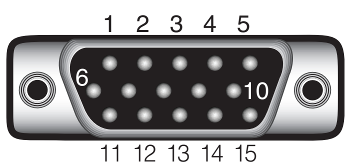


Figure 5–5 Cable end of SYSTEM IN connector.

CAUTION

The System Input port uses the same type of connector as a standard computer video monitor port, but it is electrically very different. DO NOT connect any video monitor devices to this connector. Doing so may result in damage to both the video device and the DPC.

NOTE

The connector pinout in Figure 5–4 is the female DPC panel connector. The male cable end is a mirror image and is shown in Figure 5–5.

Pin	Signal Name	Signal Description
1	+22VDC	Current limited to 250 mA maximum
2	Gnd	22VDC Return (DPC Chassis Ground)
3	Iso Oper In	Isolated Operate Input
4	Iso Oper Com	Isolated Operate Common
5	Iso Auto Cntrl	Isolated Automation Control
6	Iso Auto Com	Isolated Automation Common
7	Gnd	22VDC Return (DPC Chassis Ground)
8	Sw Oper Input	Switch Closure Operate Input
9	Not Used	Reserved for Future Use
10	Not Used	Reserved for Future Use
11	F P Lock	Front Panel Control Lock
12	Not Used	(SEQ ID0)
13	Not Used	(SEQ ID1)
14	Not Used	(SEQ ID2)
15	Not Used	(HPPI)

Table 5—IB Rev–0 Motherboard System Input Connector Signals

Rev–0

PINOUT CHANGES

The System Input pinouts shown in Tables 5—IA and 5—IB have only minor changes. They are:

Isolated Automation has its own Common on Rev–0 Pin 6. This is combined with Pin 4 on the Rev–1 board.

F P LOCK on Pin 11 Rev–0 is moved to Pin 15 on the Rev–1 board.

HPPI on Pin 15 is not used on the Rev–0 board. It is moved to Pin 11 on the Rev–1 board.

Input Signal Description

Pin 1 (+22V)

This pin can supply +22VDC at up to 250mA to power the user's automation controls.

Pin 2 (Gnd)

Pin 2 and 7 are the 22VDC, Operate and FP Lock signal returns and are tied to the chassis ground.

Pins 3 & 4 (Isolated Operate In)

These pins are isolated, polarity insensitive Operate Control inputs. When a signal of 5 to 24VDC is applied to one input and the other input is connected to ground, it will initiate the operate sequence. These inputs are functionally the same as pin 8. The current is internally limited to 12.5mA.

Pins 5 & 6 (Iso. Auto Control)

These pins are isolated, polarity insensitive Automation Control inputs. This input is designed to be used in conjunction with the optional Press Control Board. The signal is used to activate the thruster up and down. A signal of 5 to 24VDC is required at one pin and the other pin must be connected to ground. The current is internally limited to 12.5mA.

Pin 7 (Gnd)

Pin 2 and 7 are the 22VDC, Operate and FP Lock signal returns and are tied to the chassis ground.

Pin 8 (Operate)

A dry contact closure (no voltage) between pin 8 and ground (either pin 7 or pin 2) will initiate the operate sequence and is functionally the same as pins 3 & 4.

Pin 9 (Not Used)

Isolated input reserved for future use.

Pin 10 (Not Used)

Isolated input reserved for future use.

Pin 11 (F P Lock)

A dry contact closure between pin 11 and ground (pins 2 or 7) will lock out the front panel TEST key and prevent it from being activated.

Pins 12, 13, 14 (Remote Select)

Inputs reserved for future use.

Pin 15 (Hand Probe Press Inhibit)

Inputs reserved for future use.

System Output Connector

The System Output panel connector is a DB-25 Female type. Pin numbers are shown in Figure 5–6 and pin assignments are given in Table 5—IV. There is no difference between the Rev–0 and Rev–1 motherboards. Dukane cable assembly P/N 200–1302 is used to connect the DPC to custom automation equipment to monitor the welding process. A complete description of the signals and their function is given on the following pages.

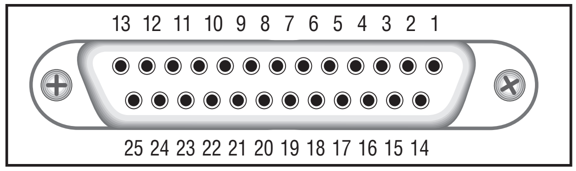


Figure 5–6 DB-25 System Output Connector

Pin	Signal Name	Signal Description
1	+22VDC	Current limited to 250 mA maximum
2	Gnd	22VDC Return (DPC Chassis Ground)
3	Gnd	Status Driver Output Ground (DPC Chassis Ground)
4	Stat Drv	Status Driver Output (1 amp maximum)
5	Not Used	Spare Output Pin
6	U/S Active	Ultrasound Status Output (Active Low)
7	Sys Fault	System Fault Output (Active Low)
8	O T Fault	Overtemperature Fault Output (Active Low)
9	O L Fault	Overload Fault Output (Active Low)
10	On Line	On Line Status Output (Active Low)
11	Gnd	Status Outputs Ground (DPC Chassis Ground)
12	Loop Fault	4–20 mA Current Loop Fault Output [1] (Active Low)
13	Gnd	Monitor Outputs Ground (DPC Chassis Ground)
14	Freq Out	Frequency Monitor Output (31Vrms maximum)
15	Amp Out	Amplitude Monitor Output (10.0V = 100%)
16	Pwr Sig	Power Signal Monitor Output [2] (1mV = 1 watt)
17	Pwr Reg Stat	Not currently available (Active Low)
18	MPC Ready	Multi–Probe Controller Ready [3] (Active Low)
19	Iso Pwr Fail	Isolated Power Fail Signal (Active Low)
20	Not Used	Isolated Output (BSP) (Active Low)
21	Not Used	Isolated Output (GP) (Active Low)
22	Not Used	Isolated Output (RDY) (Active Low)
23	Not Used	Isolated Output (ID) (Active Low)
24	Not Used	Isolated Outputs Common (Isolated Gnd)
25	Not Used	Spare Output Pin

Table 5—IV System Output Connector Signals

CAUTION

The System Output port uses the same type of connecor as a standard RS-232, DB-25 serial interface, but it is electrically very different. **DO NOT** connect any RS-232 devices to this connector. Doing so may result in damage to both the serial device and to the DPC internal circuitry.

Output Signal Description

Pin 1 (+22V)

This pin can supply +22VDC to supply power for user automation controls. It is limited to 250mA.

Pin 2 (Gnd)

Pin 2 is the 22VDC and Status Out return. It is tied to the chassis ground.

Pin 3 (Gnd)

Pin 3 is the 22VDC and Status Out return. It is tied to the chassis ground.

Pin 4 (Status Driver)

An active low output on pin 4 indicates the condition set on Jumper Block SH702 has occurred (see Figures 4-7 and 4-8). The factory default is OVERLOAD.

Pin 5 (Not Used)

Pin 5 is reserved for future use.

Pin 6 (U/S Active)

An active low output on pin 6 indicates the ultrasound is being delivered to the probe.

Pin 7 (System Fault)

An active low output on pin 7 indicates the generator has detected an out of tolerance voltage fluctuation. The front panel status display will indicate FAULT.

Pin 8 (OVERTEMP)

An active low output on pin 8 indicates that one of the power modules in the generator has overheated and automatically shut down. The front panel status display will indicate OVERTEMP.

Pin 9 (OVERLOAD)

An active low output on pin 9 indicates that excessive power beyond the generators rated output is being drawn. The ultrasonic signal is shut down when an overload condition is detected. The front panel status display will indicate OVERLOAD. The overload signal resets when the operate input deactivates or the TEST switch is released.

NOTE
Active Low outputs are open collector Darlington transistors that sink current to ground (either chassis ground or isolated common @20mA maximum). Custom automation users must supply their own pullups.

Pin 10 (ON LINE)

An active low output on pin 10 indicates the generator is on line and is capable of being triggered externally. The front panel status display will indicate ON LINE.

Pin 11 (Gnd)

Pin 11 is the 22VDC and Status Out return. It is tied to the chassis ground.

Pin 12 (Current Loop Fault)[1]

An active low output on pin 12 indicates the 4–20mA current loop output has a fault. This output is only available when a Remote Amplitude Control module (Part No. 438–799) is installed.

Pin 13 (Monitor Gnd)

Pin 13 provides a return path to the chassis ground for the monitor outputs on pins 14, 15 and 16.

Pin 14 (Freq Out)

The signal on pin 14 is the actual output frequency. It is a sine wave with an amplitude of 31Vrms maximum.

Pin 15 (Amp Out)

The signal on pin 15 is proportional to the output signal amplitude. The scale is 10.0V = 100%. This allows automation equipment to monitor the DPC amplitude setting.

Pin 16 (Pwr Sig)[2]

This output is only available when the optional Power Signal Output module (Part No. 438-826) is installed. The signal on pin 16 is proportional to the true RMS ultrasonic output power being drawn from the DPC. The scale is 1mV = 1Watt on the 20kHz, 30kHz and 40kHz models. The maximum full scale output is 4.095V (4,095 Watts). On the 50kHz and 70kHz models, the scale factor is 10mV = 1 Watt with a maximum scaled output of 409.5 Watts.

Pin 17 (Pwr Reg Status)

This option is not currently available.

FOOTNOTES

1 Requires a Remote Amplitude Control module.

2 Requires a Power Signal Output module.

Pin 18 (MPC Ready)[3]

An active low output on pin 18 indicates the MPC module (Multi–Probe Controller) is ready and will accept probe selection changes on the Remote Setup inputs.

Pin 19 (Iso Power Fail)

An active low output indicates that AC power is within operating range. This output will turn off (high impedance state which no longer sinks current), if the AC power fails or is switched off.

Pin 20 (Isolated BSP)

This signal is not available on the standard DPC II.

Pin 21 (Isolated GP)

This signal is not available on the standard DPC II.

Pin 22 (Isolated RDY)

This signal is not available on the standard DPC II.

Pin 23 (Isolated ID)

This signal is not available on the standard DPC II.

Pin 24 (Isolated Common)

FOOTNOTES

3 Requires a Multi–Probe Controller module. (Rev–1 DPC II motherboard compatiable

Remote Amplitude Control Module

Part No. 438–799

This optional module enables remote control of output amplitude of the DPC II. The control interface is a 4–20mA current loop. The current loop connector and fault indicator are shown in Figure 5–7. The output can be adjusted from 36% to 100%. The scale factor is Δ16mA = Δ64% which is Δ1mA = Δ4%. The graph of output as a function of loop current is shown in Figure 5–8. The input compliance is 10 volts minimum.

Failure to provide between 4mA and 20mA of loop current is detected as a fault and will not produce any output. The current loop fault indicator is a bicolor LED. It is green when the current is between 4 and 20mA and red when the current is below this value. The module contains an internal jumper block (SH1) to select the current loop fault option. The default setting (jumper JU1) disables ultrasonic output if a loop fault occurs The setting can be reversed with JU2 to enable the minimum level output (36%) if a loop fault occurs. This is used primarily for system testing when a current loop is unavailable.

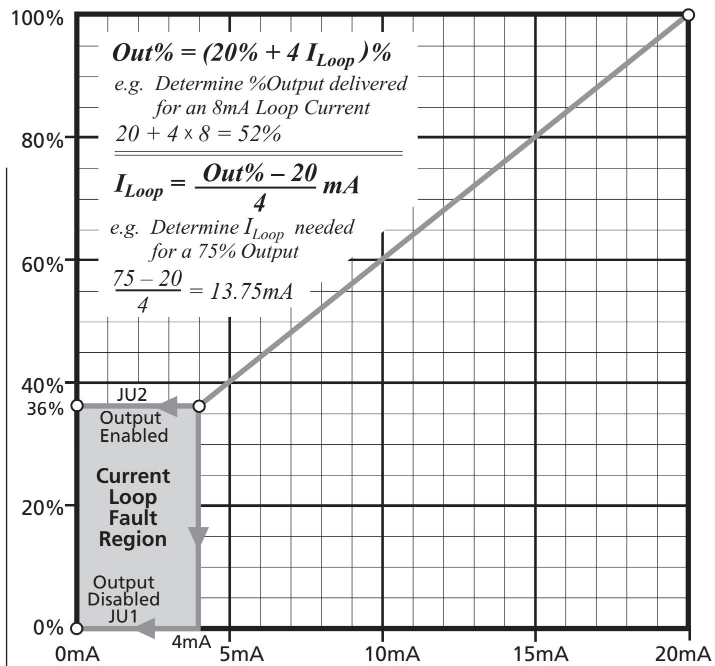


Figure 5–8 Current Loop Transfer Function Graph

> **NOTE**
> The equations for ***Out%*** and ***ILoop*** are only valid for normal operating conditions —
> ***36% ≤ Out% ≤ 100%*** and
> ***4mA < ILoop ≤ 20mA***



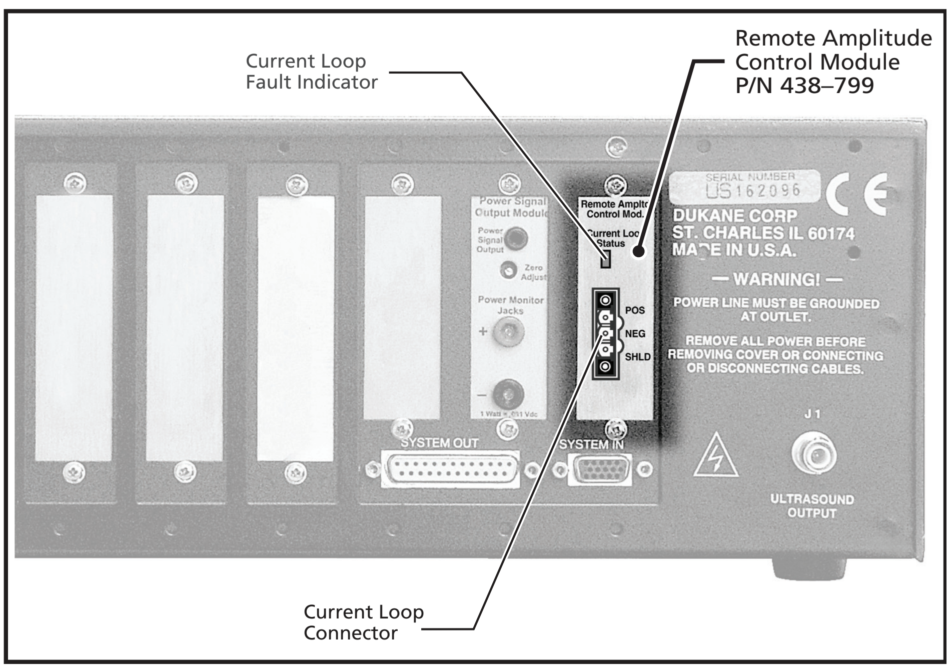


Figure 5–7 Remote Amplitude Control Module

COMPTABILITY

Rev–1

Rev–0

> **NOTE**
> The amplitude can easily be adjusted during the weld cycle. The ultra-sound amplitude will follow the user–provided ex-ternal current–loop

Manual Amplitude Control Module

Part No. 438–824 (Knob)

Part No. 438–825 (Tamper–Resistant)

This optional module enables manual control of output amplitude of the DPC II. The adjustment is made either by a control knob (438–824) or a tamper–resistant shaft (438–825). The output can be adjusted from 40% to 100%. Using a 3 1/2 digit voltmeter, the amplitude can be set to the desired level ±0.1%. The signal scaling of the amplitude monitor output jacks is 10.0Vdc = 100% amplitude. The amplitude level can be adjusted when the ultrasound output is activated.

Both modules have the same features. The knob on the 438–824 (Figure 5–9A) is secured with a shaft–lock bushing that is vibration and shock resistant. The 438–825 (Figure 5–9B) is adjusted using a small straight–blade screwdriver. A panel–mounted hole plug is provided that covers the adjustment shaft opening during normal operation.

NOTE

The output amplitude is directly proportional to the Amplitude setting, however the available output power is directly proportional to the square of the Amplitude setting.

Example: ***Since Power = E^2/R, a setting of 7.07Vdc = 70.7% = 0.707 and $(0.707)^2$ = 0.500 = 50% Power Output.***

A DPC rated at 2200 Watts set to 70.7% Amplitude will overload at 1100 Watts. (2200W x $(0.707)^2$ = 1100 Watts). To determine the required voltage setting, take the square root of the desired output power percentage.

Example: ***To limit the output power to 60%, set the voltage monitor to $\sqrt{0.60}$ = 0.775 or 7.75Vdc.***

COMPTABILITY

Rev–1

Rev–0

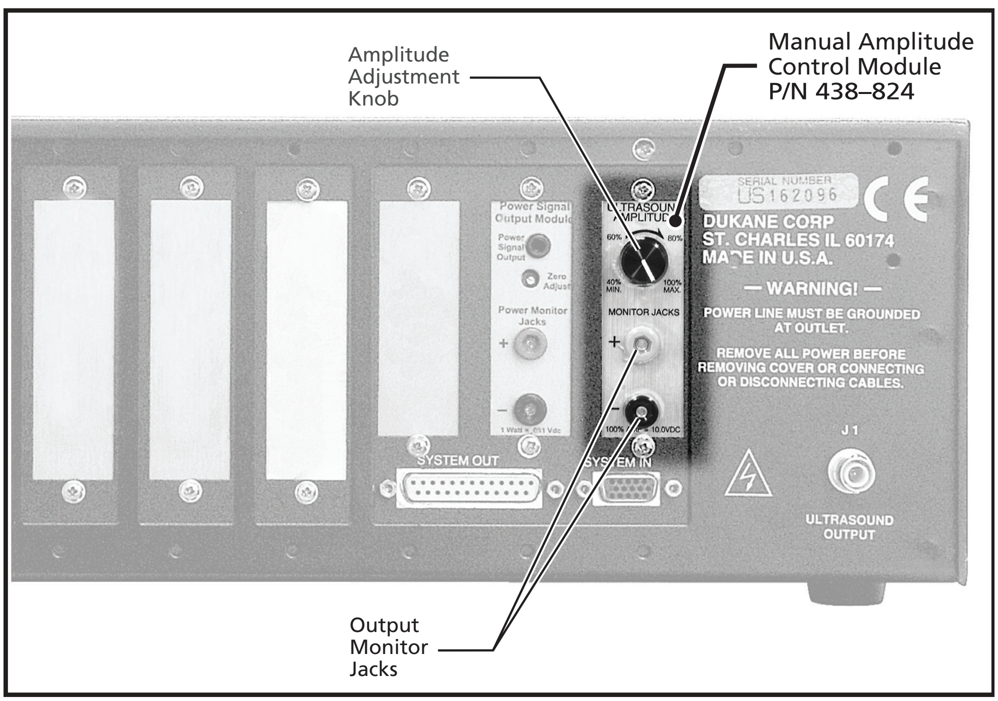


Figure 5–9A Manual Amplitude Control Module (Knob)

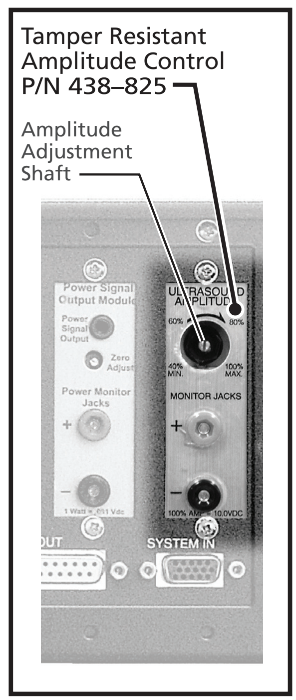


Figure 5–9B Manual Amplitude Control Module (Tamper Resistant)

Power Signal Output Module

Part No. 438–826

This optional module permits the user to monitor the True-RMS ultrasonic output power from the DPC II. Like the Amplitude Control modules, it is compatible with all versions of the DPC motherboard. The module is shown in Figure 5–10. The output signal can be monitored from three different connectors simultaneously.

1. A miniature phone jack is provided on the top of the rear panel.
2. A pair of test jacks on the rear panel allow a hand-held multimeter to monitor the power.
3. The power output signal can also be monitored by automation equipment using the System Output connector by measuring between pin 16 (Power Signal) and pin 13 (Monitor Ground Reference).

The scale factor is the same on all three outputs.

On the 20kHz, 30kHz and 40kHz models, it is 1mV = 1 Watt and the maximum full scale output is 4,095 Watts. On the 50kHz and 70kHz models, the scale factor is 10mV = 1 Watt with a maximum output of 409 Watts.

The module also features an offset adjustment to set the output to zero. The offset should only be adjusted after the DPC system has been powered up for at least 15 minutes, and with the ultrasound output deactivated.

COMPTABILITY

Rev–1

Rev–0

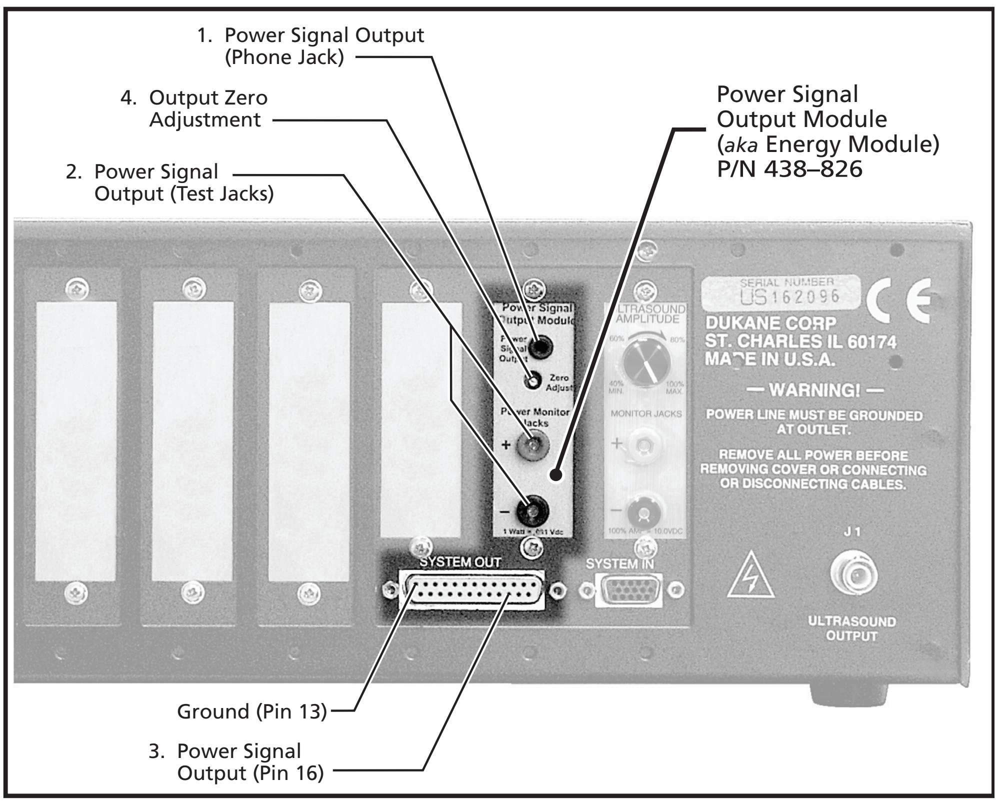


Figure 5–10 Power Signal Output Module

Press Control Module

Part No. 110–3938

This optional module enables the DPC II to control a Dukane Model 210, 220 or 410 press or custom automation. The module is shown in Figure 5–11. This module is only compatible with the Rev–1 DPC II motherboard. The cabling hookup to a press/thruster system is shown in Figures 3–7 and 3–8.

COMPTABILITY

Rev–1

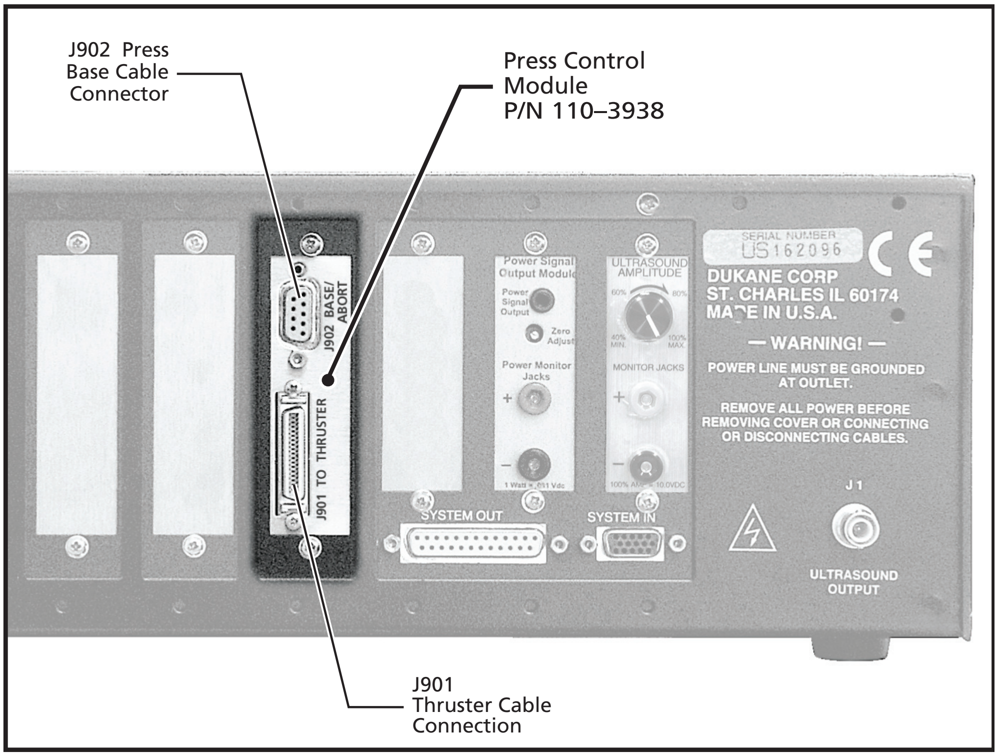


Figure 5–11 Press Control Module

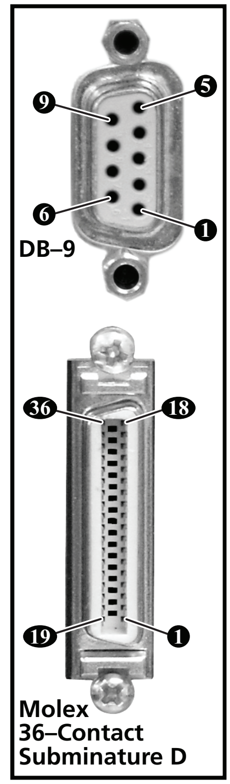


Figure 5–12 Press Connector Pin Numbers

Pin No.	Input/Output	Function	Signal Types
1	Input	Activation Switch 1	Normally open dry contact closure to ground
2	Input	Activation Switch 2	Normally open dry contact closure to ground
3	Input	Hardware Abort Power In	Normally closed emergency switch contact
4	Input	Software Abort	Normally open dry contact closure to ground
5	Ground	Internal Ground	Internal Ground
6	Ground	Internal Ground	Internal Ground
7	Ground	Internal Ground	Internal Ground
8	Input	Automation Input	Normally open dry contact closure to ground
9	+22V DC	Hardware Abort Power Out	Normally closed emergency switch contact

Table 5-V J902 Press Base Connector Pinout

NOTE

When used in a standard DPC II, the Press Control module can only control the up and down movement of the thruster. This is designed for automation control and not for use as a plunge welder. The automation system must be fully guarded for safety.

Table 5—V on the previous page lists the pinout and signal description for J902 which is the Press Base connection. Note that there is an automation input on pin 8 which is electrically identical to pin 8 on the System Input connector. This permits you to use J902 to initiate operation without having to run a separate connection to pin 8 of the System Input connector. Figure 5–12 identifies the pin numbers for both J902 and J901.

TIP

J902 Press Base connector has multiple ground pins.
The DPC–2 uses pins 5, 6 & 7 for Ground.
The DPC–2 Plus uses pins 5, 6 & 7 for Ground.
The DPC–3 uses pins 5 & 7 for Ground.
The DPC–4 uses pins 6 & 7 for Ground.

To keep your custom automation circuits compatible with DPC models, only use pin 7 for a ground connection to the Press Base connector. Note that the DPC–3 does not have an Automa-

Table 5—VI below gives the pinout and signal description for J901 which is the 36–pin Thruster connector. This connector is the same type as found on the DPC–III and DPC–IV. The cable specified is Part No. 200–1104 which is interchangeable with both DPC–III and DPC–IV generators.

Pin No.	Input/Output	Function	Signal Type
1	Output	Dual Pressure Valve	Low side Mosfet driver to ground
2	Output	Trigger LED (–)	Low side Mosfet driver to ground
3	Output	Up Valve	Low side Mosfet driver to ground
5	Output	Down Valve	Low side Mosfet driver to ground
13	Input	Dual Pressure Switch	Normally–Open dry contact switch closure to ground
14	Input	Ground Detect	Normally–Open dry contact switch closure to ground
15	Input	Trigger Switch	Normally–Open dry contact switch closure to ground
16	Input	End Of Weld Switch	Normally–Open dry contact switch closure to ground
17	Input	Pre–trigger Switch	Normally–Open dry contact switch closure to ground
4, 19, 20, 22, 24, 26	Power	+22V Press	Internal Power to Press
6, 8, 10, 12, 25, 27, 28, 29, 30, 31, 32,34, 36	Ground	+22V Return	Power and Signal Ground
7, 9, 11, 18, 21, 23, 33, 35	Unused	Unused	Unused

Table 5—VI J901 Thruster Connector Pinout

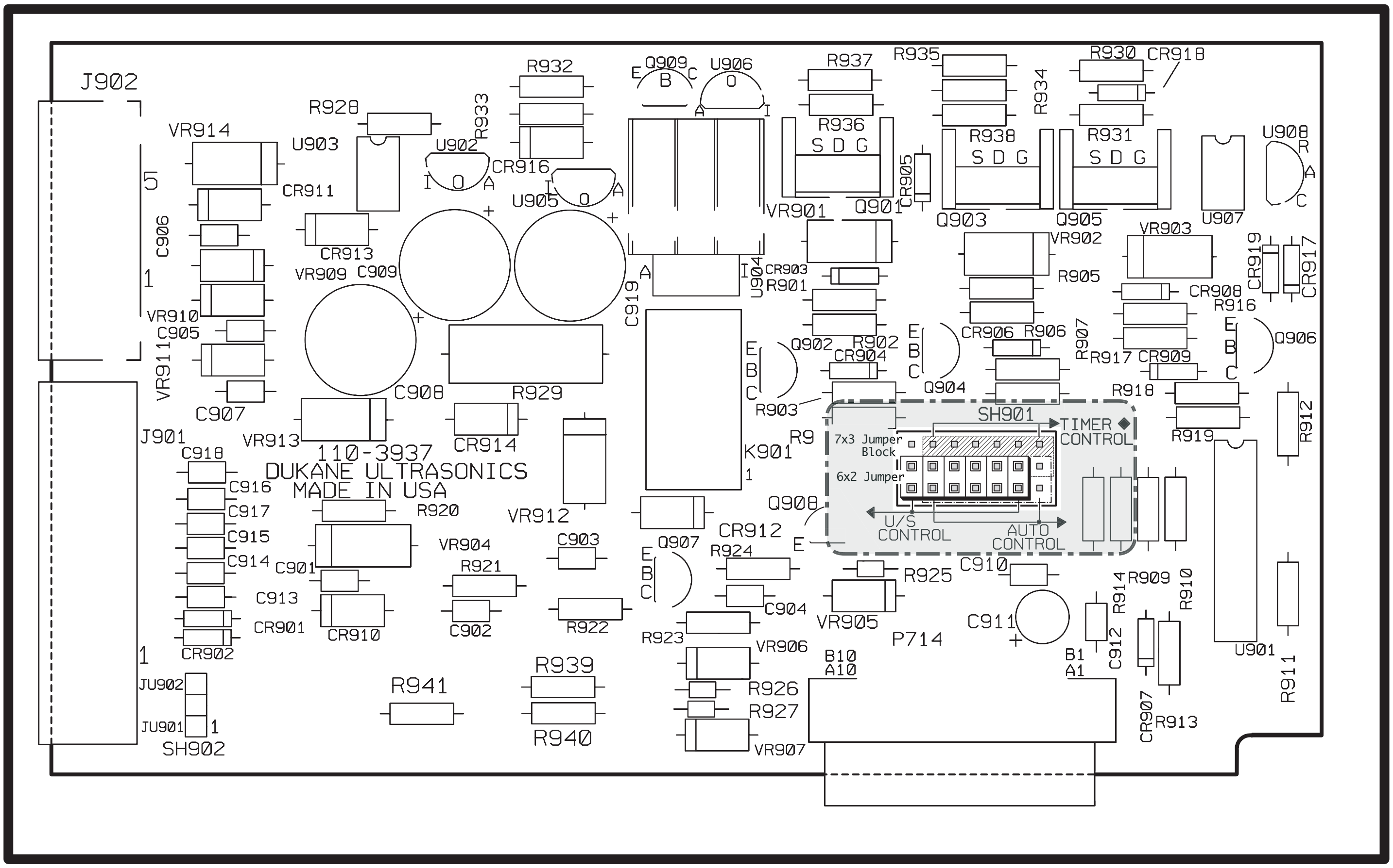


Figure 5–13 Press Board SH901 Cycle Activation Jumper

Cycle Activation Jumper Options

Internal jumper SH901 on the Press Control Board offers two options for activating a cycle when used with a DPC II generator.

U/S Control – Slave the thruster to U/S output (ideal for semi–continuous process systems). An operate initiate signal on Pin 8 of the System Input, will turn on ultrasonics and also cause the thruster to descend. This is the factory default position for a DPC II system equipped with a Press module.

Auto Control – A signal on Pin 8 will turn on ultrasonics. Automation control of Pin 5 on the System Input connector (Iso Press Control) will lower and raise the thruster. This permits separate control of thruster movement and the ultrasound signal.

Timer Control – DPC II Plus system only.

Multi–Point Master Module

Part No. 110–3954

This optional module enables the DPC II to activate any one of four ultrasonic probes. Each probe is selected by the Probe ID# (pins 12, 13 & 14) of the HD–15 System Input connector (see Table 5—II). Rear panel bicolor LED status indicators for each probe output illuminate green when the probe channel is selected and red when the U/S is active. The Multi–Point module is only compatible with the Rev–1 DPC II motherboard. Both a MPC Master and Slave module are shown below in Figure 5–14.

Internal logic prevents more than one probe from being activated at a time or probe switching signals when the U/S is on. A ring-down circuit permits switching only when U/S output is zero. Internal fault logic senses any malfunction and deactivates the MPC Ready output. The Multi–Point Controller cannot be used with a press module. The master module has an extra wide back panel to prevent it's accidental use with the press module.

Part No. 110–3956

This optional module adds four additional probe selection channels to the DPC II. This gives a total of eight probe channels. The slave module cannot be used alone. It must be used with the master module. An internal connector supplies the ultrasound signal from the Master module. As with the Master module, each output channel has a bicolor LED status indicator that illuminates green when the probe channel is selected and red when the U/S is active.

COMPTABILITY

Rev–1

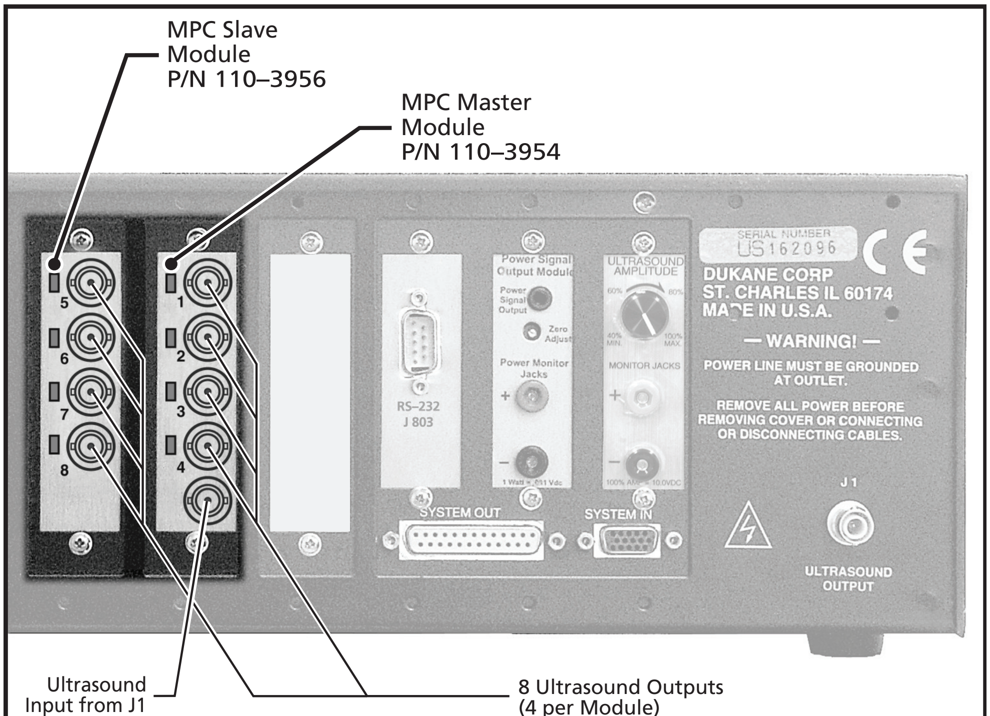


Figure 5–14 Master and Slave Multi–Point Controller (MPC) Modules

NOTE 1
External automation can be used to select the probe. In a DPC II system, the external automation also controls the weld and hold times.

NOTE 2
The Ultrasound input on the MPC Master must be connected to the DPC Ultrasound output connector with a RG62B/U coax. This is indicated as Cable 2 in Figure 3–6 (Part No. 200–479–01).

Jumper Block Options

The DPC II may be customized to your specific requirements by means of internal jumpers located on the main printed circuit board. There are two versions of the motherboard in the DPC II. The original DPC II model used the DPC II board (Rev–0). The later models utilize the same board as the DPC II Plus (Rev–1). The jumper blocks for both models are listed here with their default factory settings and alternate positions. Figures 5–15 and 5–16 on the following pages show the location of the jumper blocks for the later design (Rev–1) in more detail. Figures 5–17 and 5–18 show the location of the jumper blocks for the earlier design (Rev–0). The factory default setting is indicated by a diamond ◊ next to the description. Figure 5–3 shows the major identifying differences between the two board designs.

Status Driver Normal State Selection (Rev–0 & Rev–1)

Jumper Block – SH701 (Pin 4 output on DB-25)

JU701 - Normally OFF (Factory Default)
JU702 - Normally ON

Status Driver Selection (Rev–0 & Rev–1)

Jumper Block – SH702 (Pin 4 output on DB-25)

JU703 - Ultrasound Active Status
JU704 - Overload Fault (Factory Default)
JU705 - Over Temperature Fault
JU706 - System Fault
JU707 - Any Fault

Automation Cycle Stop or End Of Weld Selection (Rev–0 & Rev–1)

Jumper Block – SH704

JU713 - Normally OFF (Factory Default) – Use depends upon custom automation configuration
JU714 - Normally ON
JU715 - Automation Stop Fault – Move jumper to this position to use Auto Stop (Figure 7–13)
JU716 - Automation End of Weld (Factory Default)

Switch Debounce Filter Time Delay Selection (Rev–0 & Rev–1)

Jumper Block – SH705

JU717 - No Time Delay (used for electronic switches)
JU718 - 1 msec
JU719 - 10 msec (Factory Default)
JU720 - 22 msec

Timer Board Enable/Bypass (Rev–1 Only)

Jumper Block – SH706

JU723 - Timer Board Enable (selected for a DPC II Plus)
JU722 - Timer Board Bypass (Factory Default – used for standard DPC II)

System Control Inputs (Rev–1)

Jumper Block – SH707

JU724 - Non–Isolated Sink (Factory Default) – Dry contact between input and DPC ground.

JU725 - Non–Isolated Source – Dry contact between input and +22 VDC.

JU726 - Isolated Source – Input can be either sinking or sourcing. A signal of 5 to 24 VDC is required at the isolated inputs. The current is internally limited to 12.5mA.

Since a Rev–0 motherboard does not have a SH707 jumper block, automation control circuits require different connections depending on type of motherboard. Connections for both a Rev–0 and Rev–1 motherboard are given in Appendix C.

Rev–1 Motherboard Layout

Rev–1

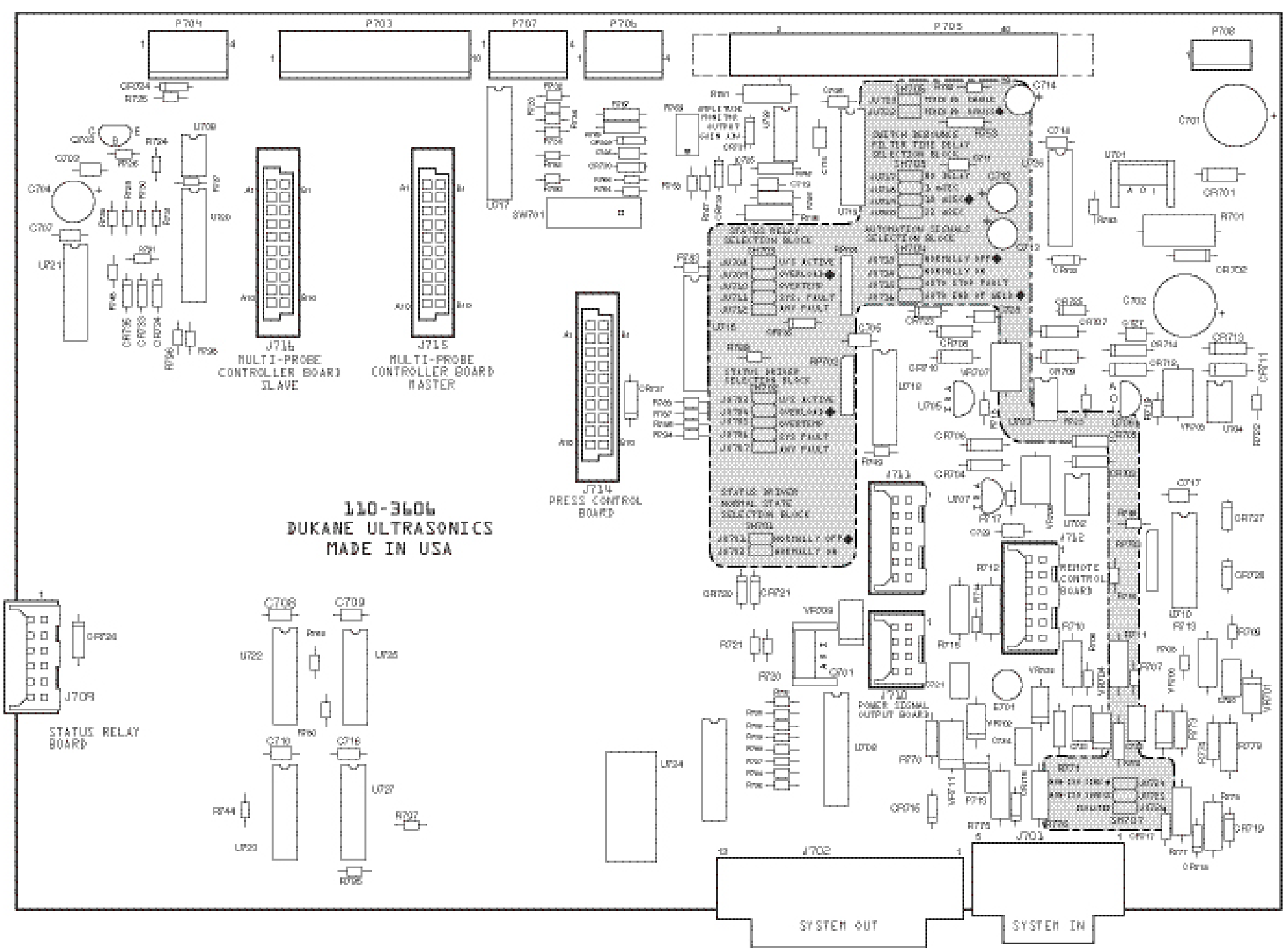


Figure 5–15 Rev–1 Motherboard Showing Card Slots, Connectors and Jumper Block Locations

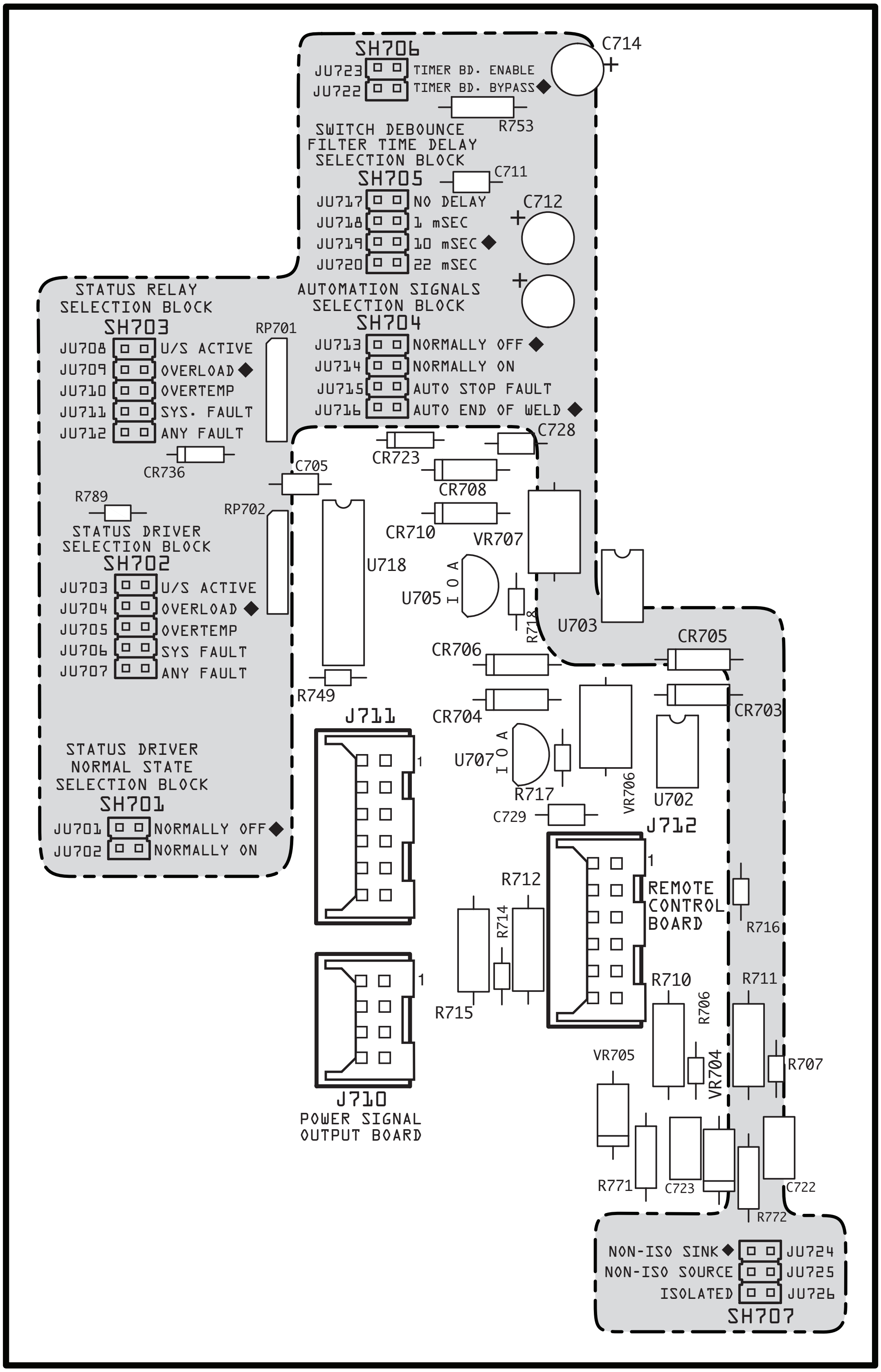


Figure 5–16 Rev–1 Motherboard Jumper Block Detail

Rev–0 Motherboard Layout

Refer to Figure 5–3 to identify the characteristics which quickly determine whether the motherboard is Rev–0 or Rev–1.

Rev–0

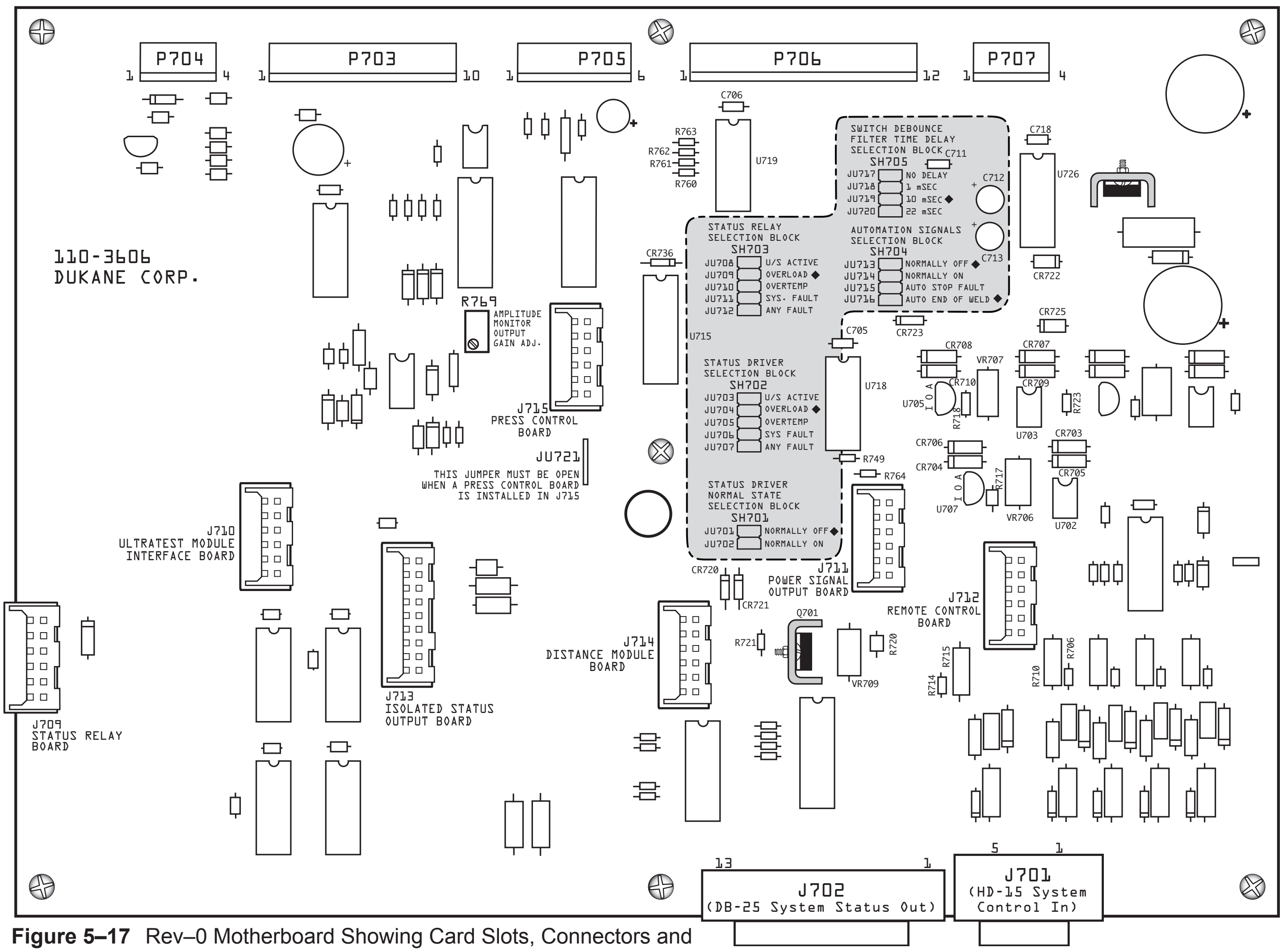


Figure 5–17 Rev–0 Motherboard Showing Card Slots, Connectors and Jumper Block Locations

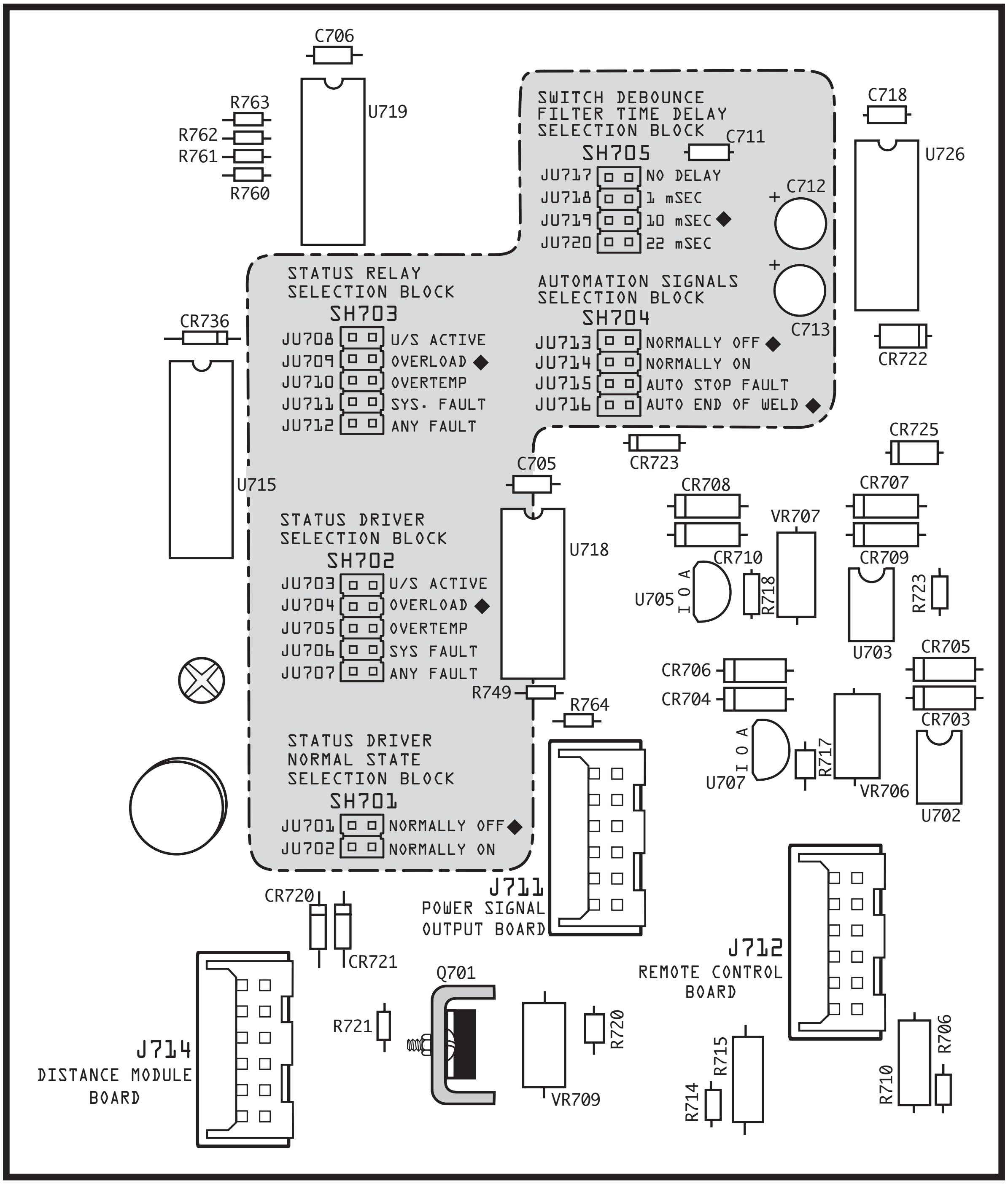


Figure 5–18 Rev–0 Motherboard Jumper Block Detail

SECTION 6

Probes & Probe Stacks

- Theory of Operation
- Probe Configuration
- Probe Stack Assembly
- Booster Notes
- Probe Stack Mounting

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The Ultrasonic Probe

Theory of Operation

Plastic welding is the most common application of ultrasonic assembly. To perform ultrasonic plastic welding, the vibrating tip is brought into contact with one of the work pieces. Pressure is applied and ultrasonic energy travels through the material generating frictional heat at the contact point of the two parts. The frictional heat melts a molded ridge of plastic on one of the pieces and the molten material flows between the two surfaces. When the vibration stops, the material solidifies forming a permanent bond.

Probe Configuration

A basic ultrasonic probe package consists of —

1. A probe housing which contains the transducer to convert the electrical energy supplied by the generator into mechanical vibrations.
2. A horn to transfer the mechanical vibrations from the probe to the parts to be welded.

Optional components include special replaceable tips which can be threaded on to the tip of the horn, and a booster to amplify the mechanical vibrations of the horn. A basic hand–held probe system is shown in Figure 6–1. The hand probe is easily identified by its trigger actuator and permanently attached cable. Normally a booster is not used with a hand probe as this increases the length and weight and reduces its versatility. The optional threaded titanium tip can be used when the application calls for a staking profile or a pointed spot weld. Replaceable tips are not commonly used in high–volume production environments.

A mounted probe lacks the trigger actuator and has a HV–BNC connector for attaching the high voltage coaxial cable. A mounted probe may also have a booster to change its output amplitude.

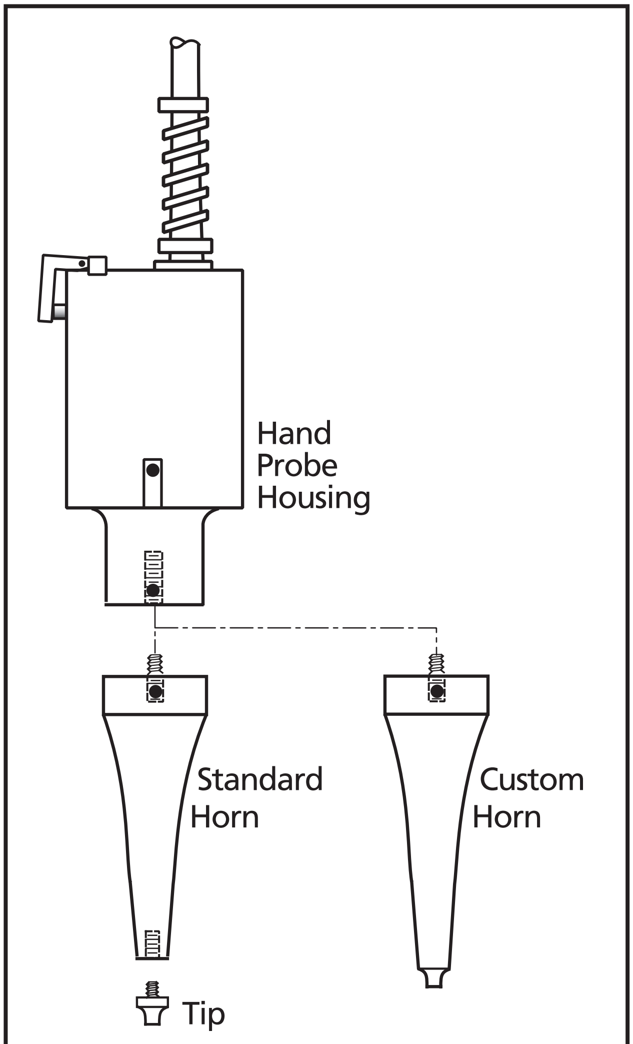


Figure 6–1 Hand Probe, Horn and Tip

Ultrasonic Horn

The horn transfers the ultrasonic mechanical vibrations (originating at the transducer in the probe housing) to the plastic parts through direct physical contact. The horn is precision machined and designed to vibrate at either 15kHz, 20kHz, 30kHz, 40kHz, 50kHz or 70kHz. The tuning is accomplished using electronic frequency measurement. Inherent variations in material composition prevent tuning by dimensional machining alone.

There are many different horn profile styles depending upon the process requirements. Factors which affect the horn design are the materials to be welded and the method of assembly. Horns are usually constructed from aluminum, hardened steel or titanium. As the frequency increases, vibration amplitude typically decreases, but internal stress in the horn increases. Higher frequencies are used for delicate parts that cannot handle a lot of amplitude. Some factors to keep in mind for high–frequency (e.g. 40kHz) ultrasonic welding versus low–frequency (e.g. 20kHz) ultrasonic welding are listed here.

1. Stress in the horn is higher at high frequencies.
2. Wear on the horn is greater at high frequencies.
3. Clean and flat mating surfaces between the horn, booster and transducer are more critical at high frequencies.

Booster

The function of a booster is to alter the gain (i.e. output amplitude) of the probe. A booster is amplifying if its gain is greater than one and reducing if its gain is less than one. A neutral or coupling booster is used to provide an additional clamping location for added probe stack stability. A probe designed to be mounted in a fixture along with a booster and horn is shown in Figure 6–2. This is

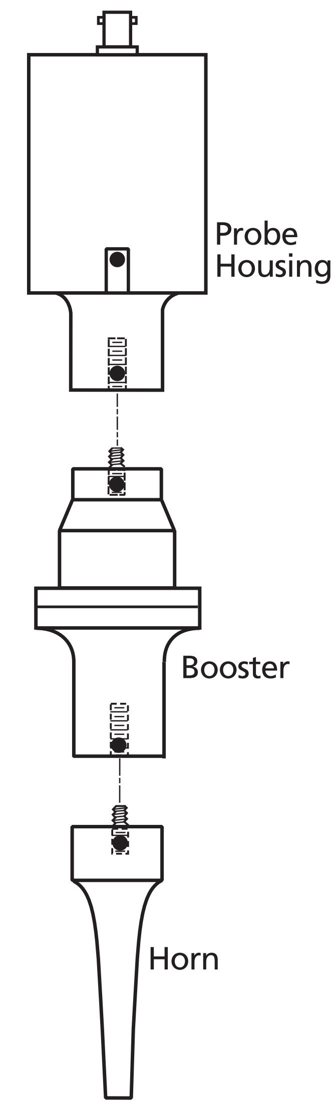


Figure 6–2 Probe Stack With Probe, Booster & Horn

commonly referred to as a stack. As indicated, the components are secured with threaded studs.

Probe Selection

The DPC II Generator is designed to be used with both hand–held ultrasonic probes and mounted probes in custom fixtures for automation control. Hand probes are used where maximum operator control or relatively low static forces are desirable. They are well suited for short production runs requiring spot welding or inserting. Hand probes are also used when assemblies are too large to be assembled in press systems or which have areas that are dificult to reach. Tapped horns with various types of replaceable titanium tips are available. When properly tuned, most of these tips are interchangeable. The most common hand–held 20kHz probe used with the DPC II is the 41D26 which consists of a 41C26 probe and a 14-pin Amphenol to HD-15 adapter cable for connection to the DPC System Input. A drawing of a 41C26 probe is shown in Figure 6–5.

Dukane offers an ergonomically designed pistol grip for the 20kHz hand probe (41C26/41D26). This lightweight housing (shown in Figure 6–3) ensures more accurate spot welding and reduces operator fatigue and the risk of repetive stress injuries.

Probes can also be mounted in fixtures and are readily adaptable to customer actuator or automation installations. The common choices for machine automation application are the 41C27 or the 41C30 HD probes. These probes are shown in Figures 6–6 and 6–7 respectively. For specialized applications such as food processing, the 41C30 is offered in a sealed, air cooled, non–contaminating stainless steel package. This is the 41S30 probe and is shown in Figure 6–8.

For custom automation systems, Dukane also has a support mount for the 41C30 HD 20kHz probe with machined aluminum transducer and booster clamps. Figure 6–8 shows a sealed HD probe secured in this mount.

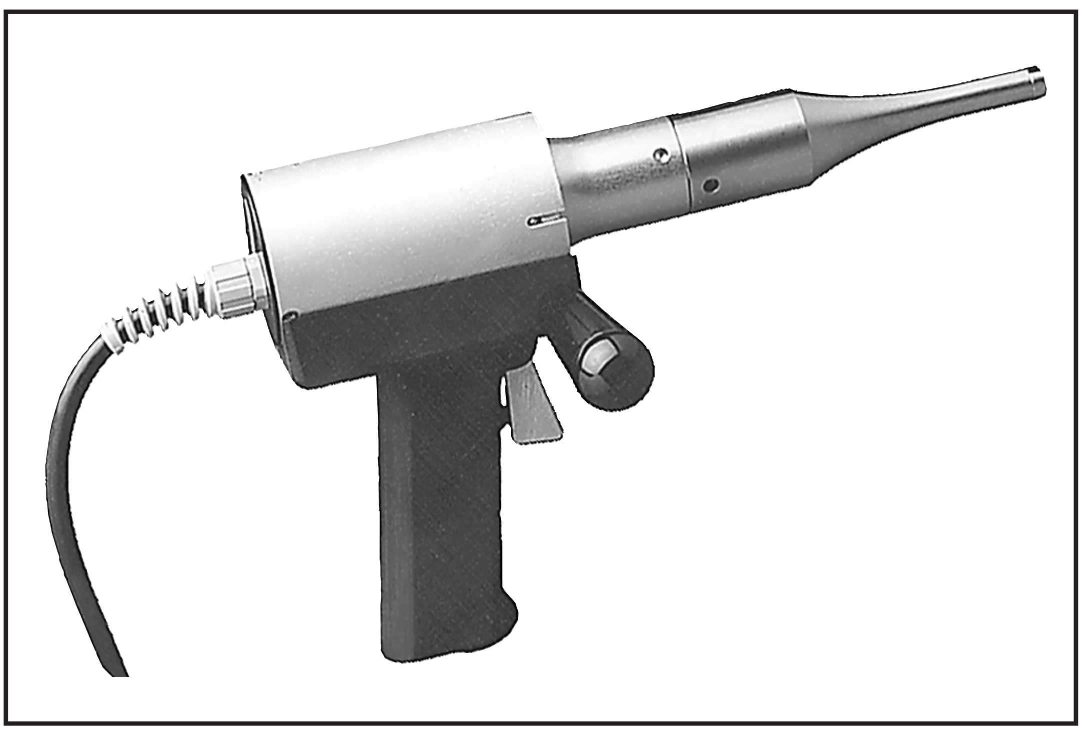


Figure 6–3 Pistol Grip Installed On a 20kHz Hand

For 40kHz applications, the standard hand probe is the 41B33 which consists of a 41A33 probe and a 14-pin Amphenol to HD-15 adaptor cable. A model 41A33 hand probe is illustrated in Figure 6–9. For machine automation applications, the 41C28 is the most common 40kHz mounted probe and is shown in Figure 6–10. This is also offered in a sealed package as a 41S28 and shown in Figure 6–11. The sealed probes have water and steam–proof cables with liquid–tight MIL-SPEC connectors. Sealed probes are also useful in areas which cannot tolerate the possibility of an electrical spark.

Note that the probes do not include a horn or replaceable tip. The probe drawings show a generic horn attached to the probe. A list of the 20kHz and 40kHz probes is given in Table 6—I below. Horns are available in different materials and sizes. They are matched to the plastic material to be welded, the type of weld joint and the probe frequency. Contact Dukane or your local Dukane representative for specific information on horns, replaceable tips and 50kHz–70kHz probe applications.

NOTE
A commercial torque reaction arm (shown in Figure 6–4) can also be used with hand probes. The counterbalanced arms maintain perpendicular motion and reduce operator fatigue.

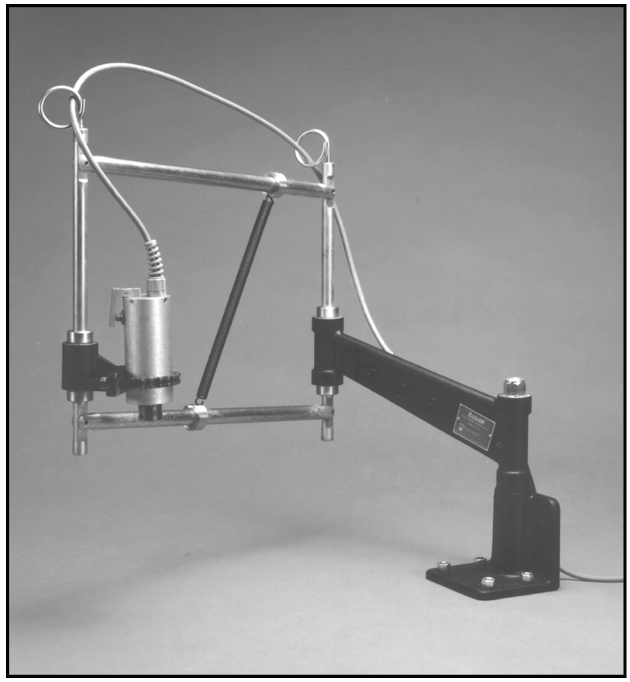


Figure 6–4 Torque Reaction Arm and Hand Probe

Model	Probe Description	Figure
41D26	20 kHz DPC Hand Probe	6–5
41C27	Standard 20 kHz Probe	6–6
41C30	Heavy Duty 20 kHz Probe	6–7
41S30	Sealed HD 20 kHz Probe with Stainless Steel Can & Air Cooling	6–8
41B33	40 kHz Hand Probe (350 & 700 Watt)	6–9
41A39	40 kHz Hand Probe (1000 Watt)	6–9**
41C28	Standard 40 kHz Probe	6–10
41A38	40 kHz Probe (1000 Watt)	6–10**
41S28	Sealed 40 kHz Probe with Stainless Steel Can & Air Cooling	6–11

** Same overall dimensions as probe illustrated. Front slug of probe housing is slightly different.

Table 6—I 20kHz and 40kHz DPC II Compatiable Probes

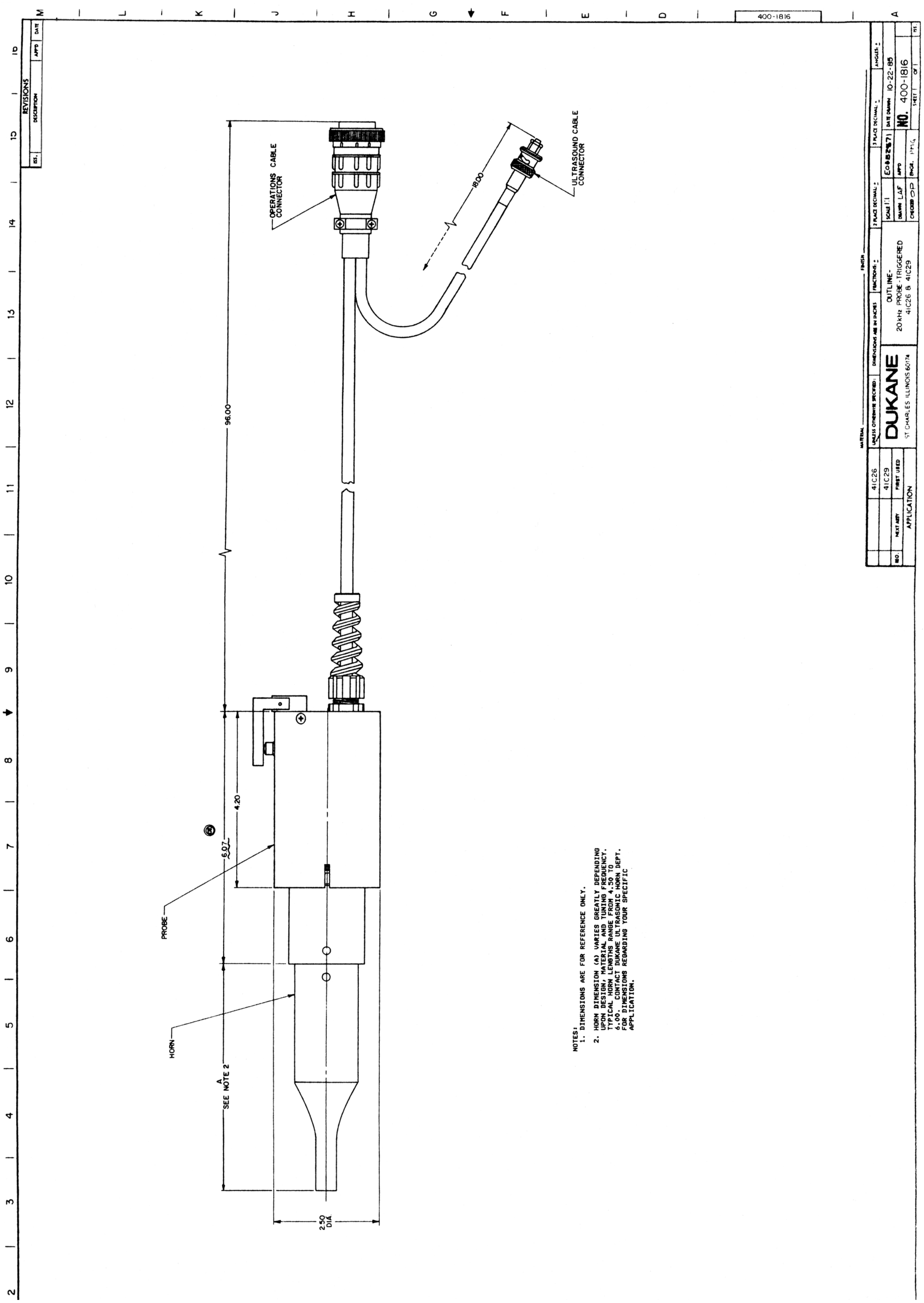


Figure 6–5 Model 41C26 20kHz Hand Probe

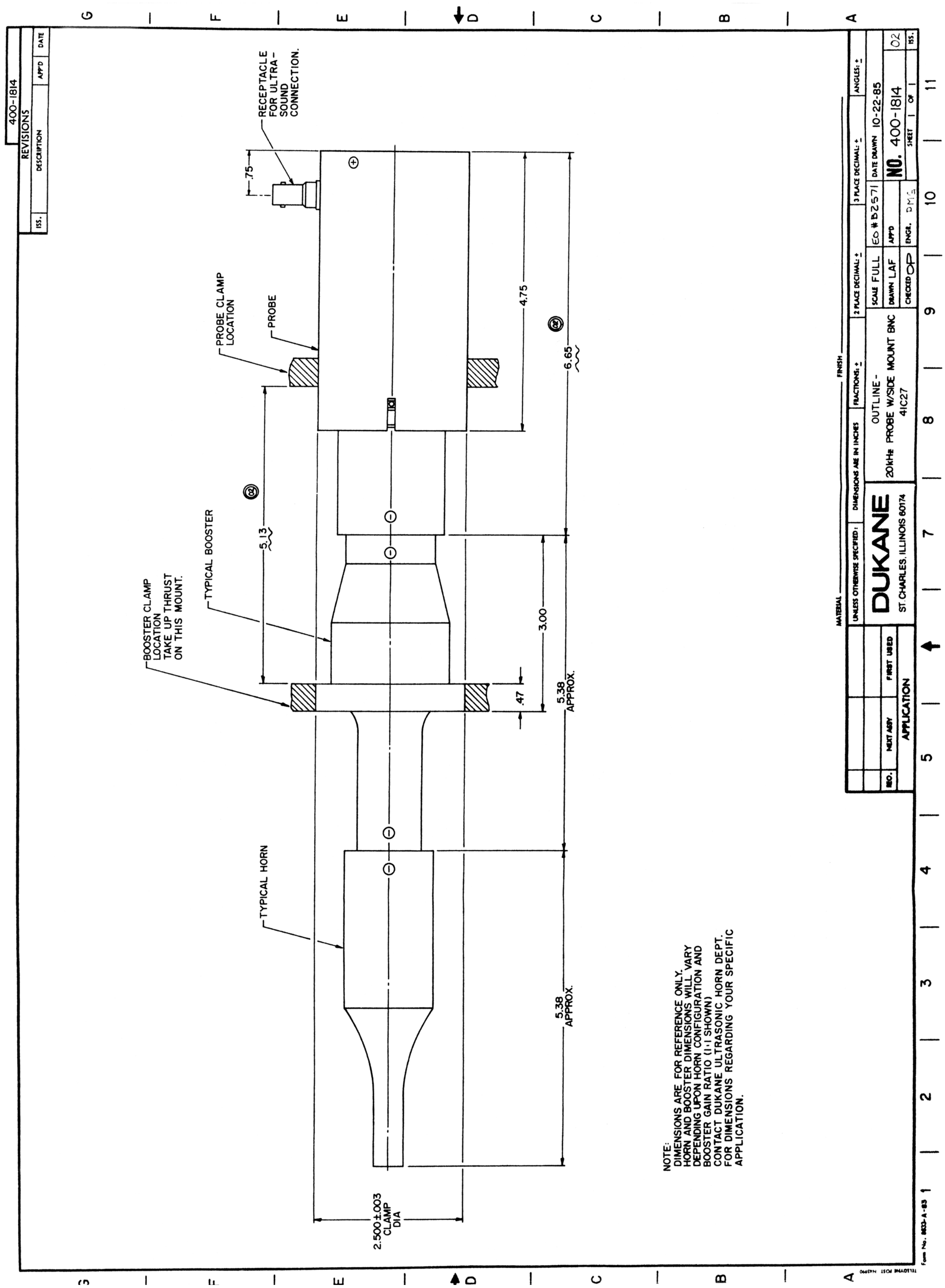


Figure 6–6 Model 41C27 20kHz Mounted Probe

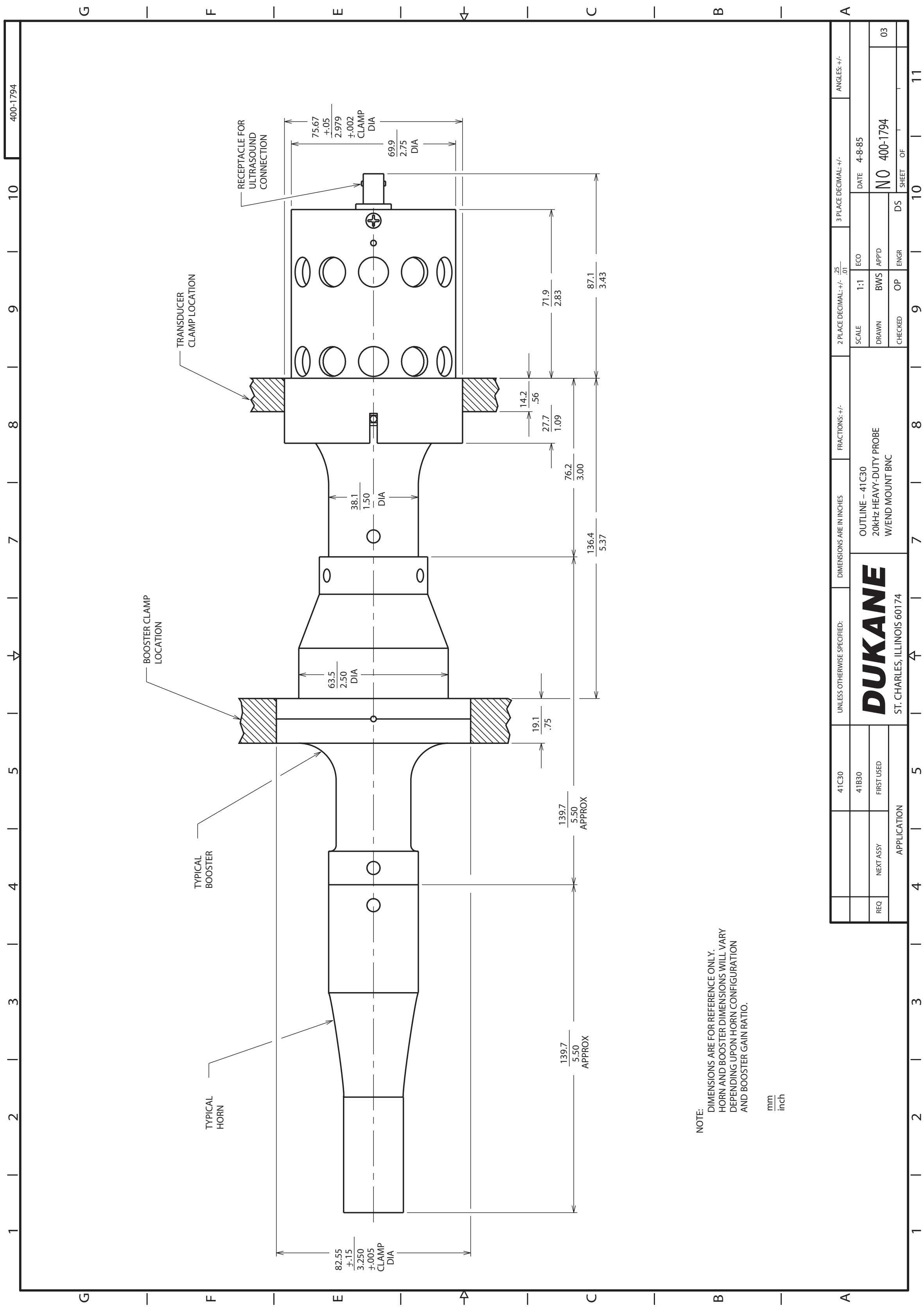


Figure 6–7 Model 41C30 20kHz HD Mounted Hand Probe

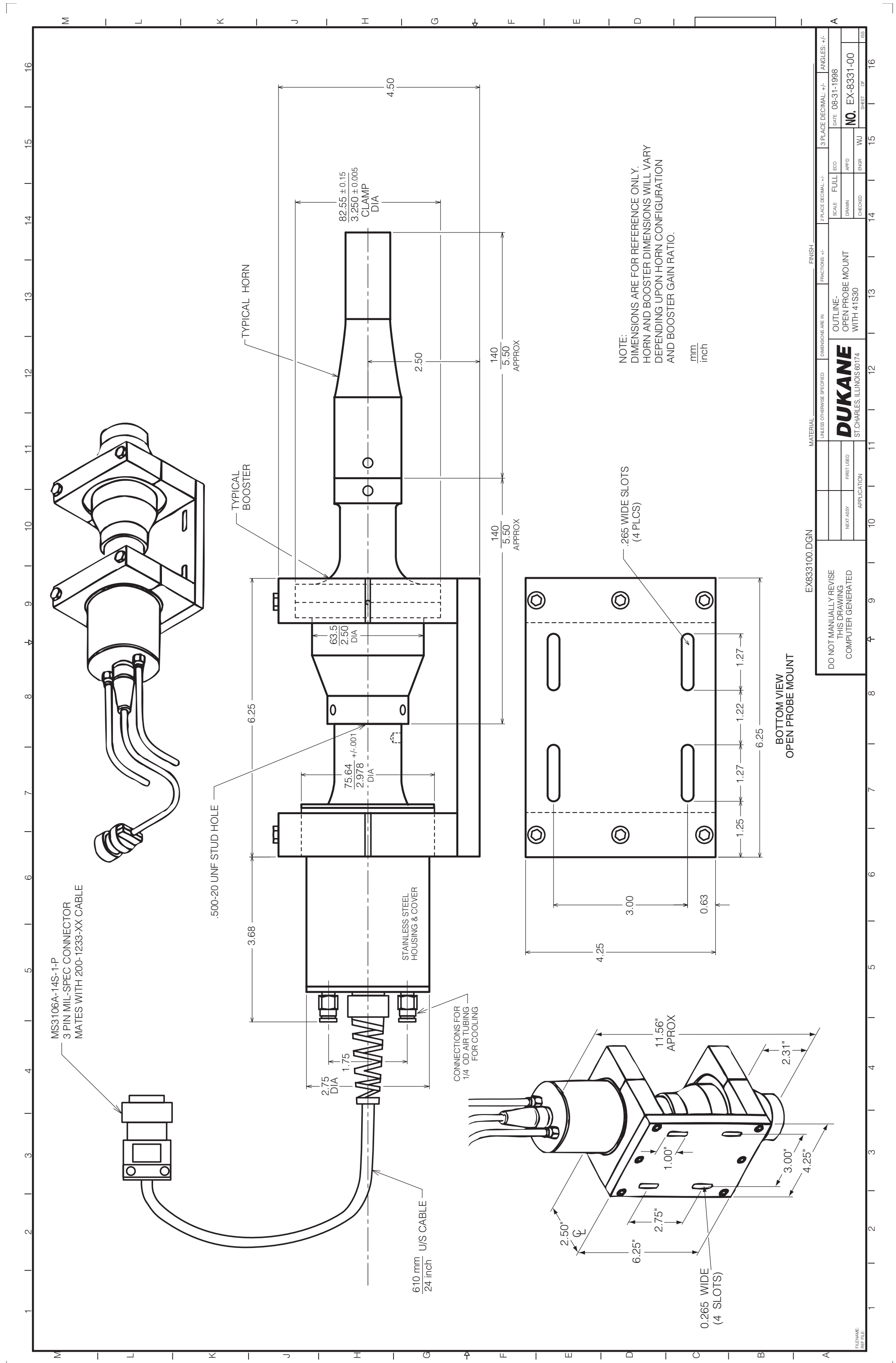


Figure 6–8 Model 41S30 20kHz Sealed Probe in Mount

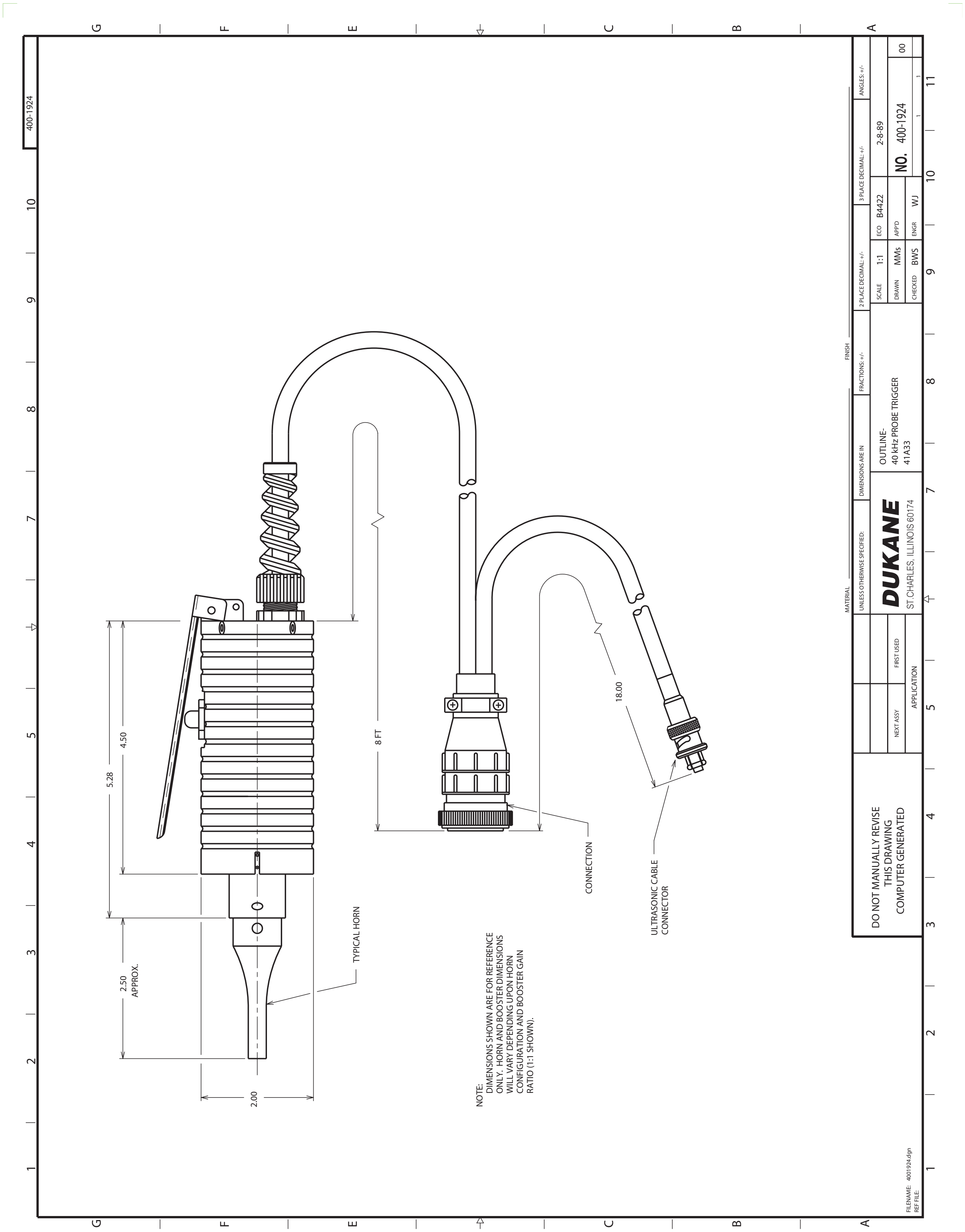


Figure 6–9 Model 41A33 40kHz Hand Probe

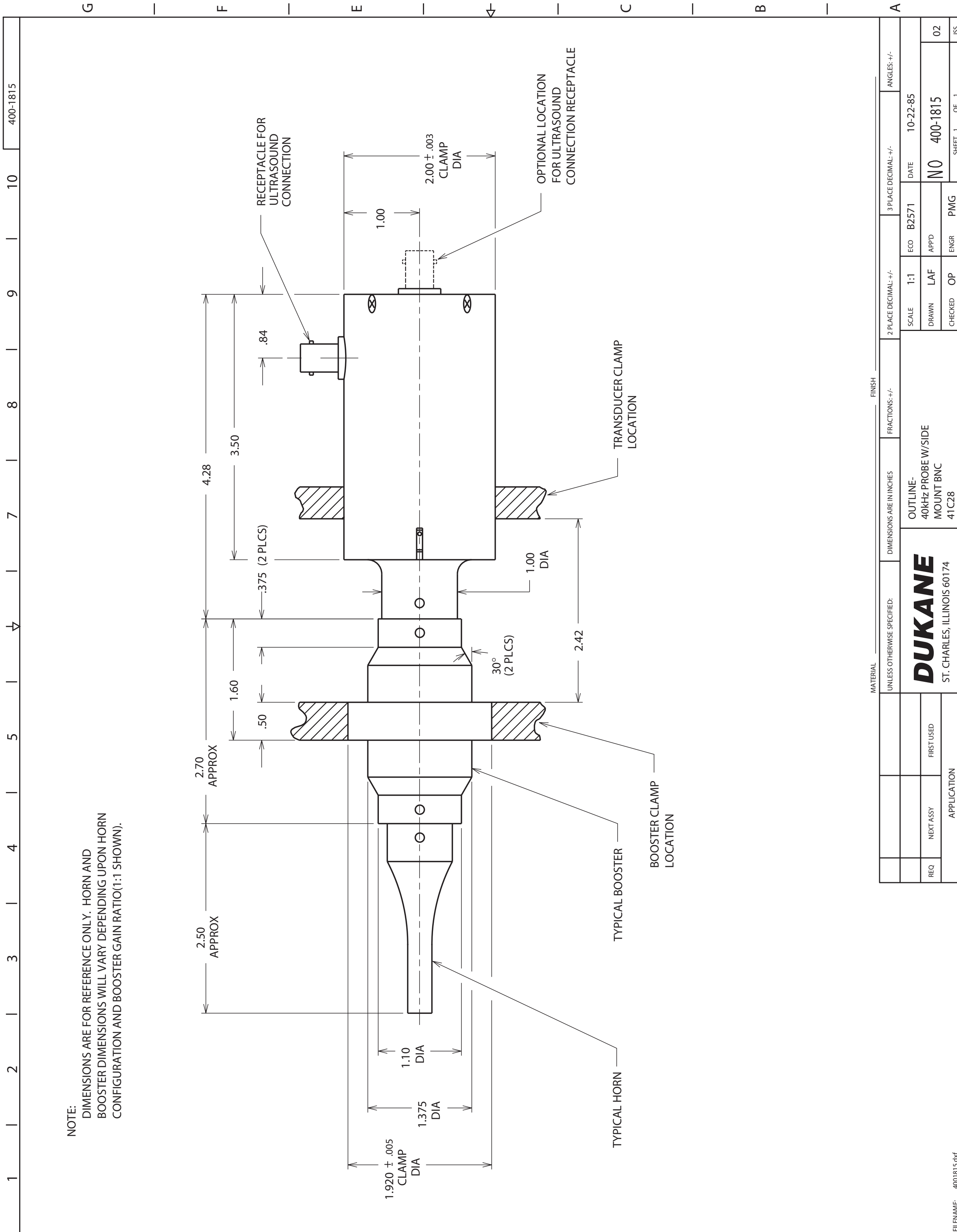


Figure 6–10 Model 41C28 40kHz Mounted Probe

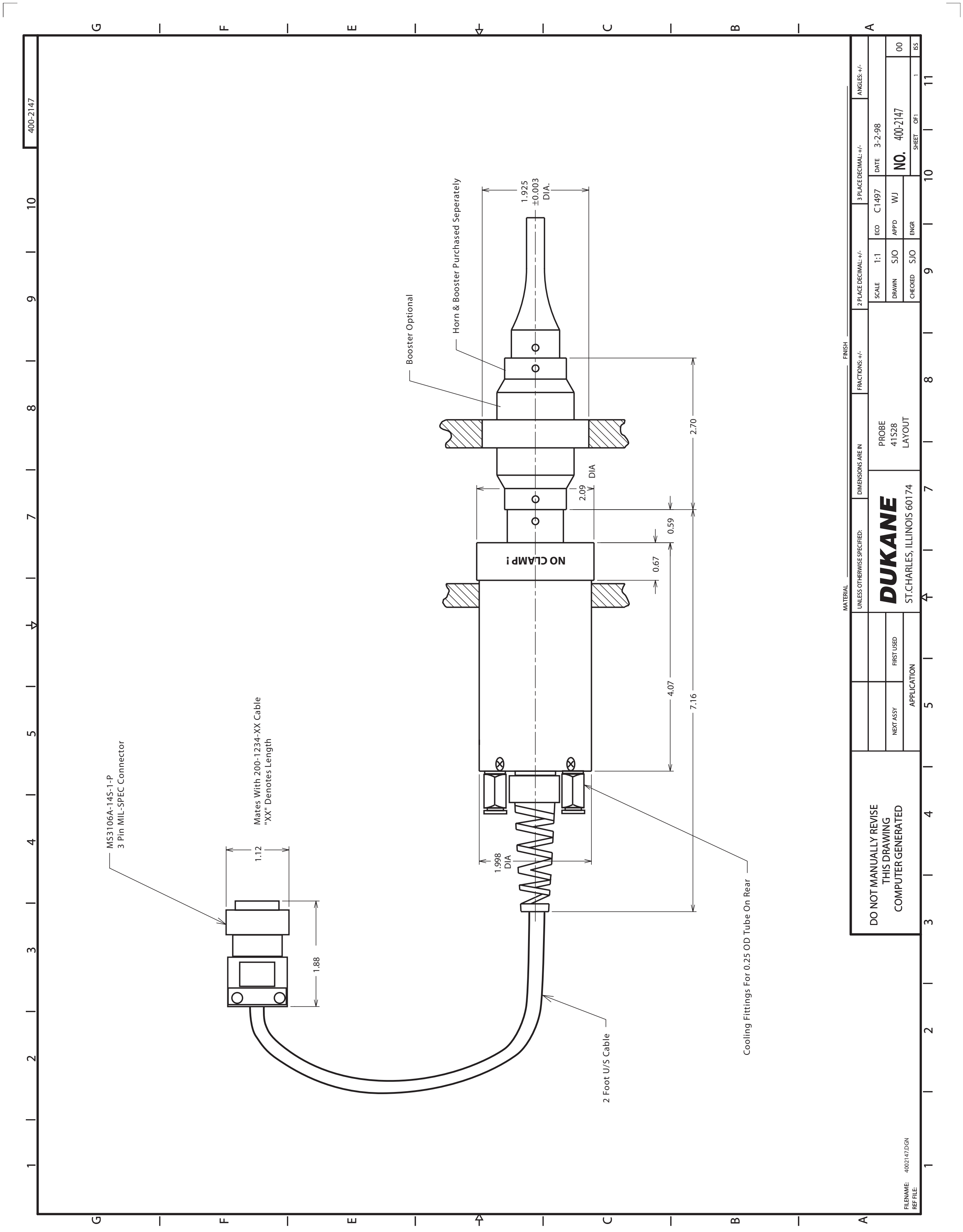


Figure 6–11 Model 41S28 40kHz Sealed mounted Probe

Stack Assembly

Attaching A Replaceable Tip To A Horn

1. Inspect all horn and tip surfaces for stress cracks, chips, or gouges. Any of these irregularities will affect operation and could lead to further equipment damage. Contact the Dukane Ultrasonics Tooling Department concerning damaged horn components.
2. Apply an extremely thin layer of a high temperature, high pressure silicon grease to the back surface that mates with the horn. The grease will allow both surfaces to intimately mate and become acoustically transparent which improves the energy transfer. Do not apply any grease to the threads. We recommend Dow–Corning #4 (or #111 as an alternate). A small packet of Dow–Corning #4 is supplied with the system. If you cannot use a silicon–based grease in your facility, a petroleum–based grease may be used. However, it is likely to leave carbonaceous deposits on the surface, and require more frequent joint maintenance. Failure to follow these instructions, may result in the mating surfaces bonding and difficulty removing the tip from the horn.
3. Thread the tip into the horn and tighten to the torque specifications below using an open end wrench of the correct size to fit the wrench flats of the tip. This is illustrated in Figure 6–12. If necessary, use a spanner wrench (on horns with spanner wrench holes) or an open end wrench (on horns with wrench flats) to keep the horn from turning in your hand. A canvas strap wrench is permissible if it does not gouge or scratch the horn.
   - 70 inch-lbs for an 8mm threaded tip
   - 100 inch-lbs for a 3/8" x 24 threaded tip
   - 160 inch-lbs for a 1/2" x 20 threaded tip

NOTE
Do not apply any grease to the threads of the replaceable tip. This may cause the tip to loosen from the horn resulting in inconsistent opera-

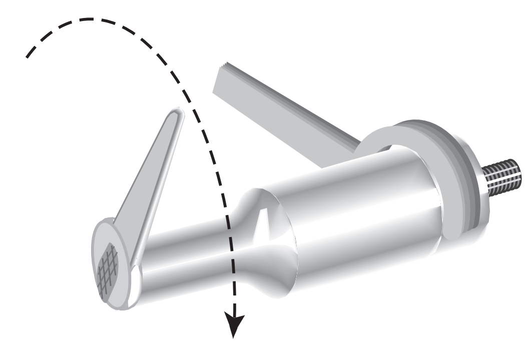


Figure 6–12 Replaceable Tip Installation

NOTE
Dukane Part No for the 20kHz spanner wrenches is 721–68

Dukane Part No for the 40kHz spanner wrenches is 721–44

Attaching The Mounting Stud To A Horn Or A Booster

1. Inspect the stud for cracks or damaged threads. Replace the stud if it is cracked or otherwise damaged.

2. Remove any foreign matter from the threaded stud and the mating hole.

3. Thread the mounting stud into the input* end of the horn or the input* end of the booster and tighten to the following torque specifications using an allen wrench in the socket head of the mounting stud. Table 6—II lists the torque specifications in units for both English and Metric systems of measurements. Figure 10–5 is a handy conversion graph if you require intermediate values not listed in the tables.

   DO NOT hold the booster by the mounting rings when tightening stud. The mounting rings have a shear pin which could snap under excessive torque. Use a spanner wrench (on horns with spanner wrench holes) or an open end wrench (on horns with wrench flats) to keep the horn or booster from turning in your hand.

   - 70 inch-lbs for an 8mm threaded stud
   - 100 inch-lbs for a 3/8” x 24 threaded stud
   - 160 inch-lbs for a 1/2” x 20 threaded stud

inch–lbs	ft–lbs	N–m
70	5.8	7.9
100	8.3	11.3
160	13.3	18.1

Table 6—II Stud Torque Unit Conversions

* Always assemble the mounting studs that mate boosters, transducers and horns to the input end of the horn or the input end of the booster first. This is shown in Figures 6–15 and 6–16.
NEVER thread a stud into the transducer or the output end of the booster first. See Booster Notes in this section for correctly identifying the output end of a booster.

> NOTE
> Do not apply any grease to the stud threads or the tapped hole. This may cause the stud to loosen. If the stud wanders within the joint, it can vibrate, resulting in excessive heat. In some cases, this can melt the tooling material.

> NOTE
> To convert inch-lbs to ft-lbs, divide by 12
> *e.g. 100 inch–lbs ÷ 12 = 8.3 ft–lbs*
>
> To convert inch-lbs to Nm, divide by 8.852
> *e.g. 100 inch–lbs ÷ 8.852 = 11.3 Nm*
>
> To convert ft-lbs to Nm, multiply by 1.356
> *e.g. 10.8 ft–lbs x 1.356 = 14.65 Nm*
>
> To convert Nm to ft-lbs, multiply by 0.7376
> *e.g. 18.1 Nm x 0.7376 = 13.35 ft–lbs*
>
> Torque specifications have a tolerance of about ± 10%.
>
> See Figure 6–14 for a handy conversion

Attaching The Horn To A Booster, Booster To A Probe, Or Horn To A Probe

1. Inspect all surfaces to be joined for stress cracks, chips, or gouges. Any of these irregularities will affect operation and could lead to further equipment damage. Contact the Dukane Ultrasonic Tooling Department concerning a damaged booster.
2. Ensure that the mating surfaces of the two components are clean and smooth. These surfaces must make intimate contact for the mechanical energy to pass from one component to the next. Pitting or a buildup of old grease and dirt on a mating surface will interfere with the energy transfer and reduce the power delivered.
3. Make sure that the stud in the horn or booster is tight. See the preceding mounting stud assembly instructions for torque specifications.
4. Remove any foreign matter from the threaded stud and mating hole.
5. Apply an extremely thin layer of a high temperature, high pressure silicon grease to the surface that mates with the horn. The grease will allow both surfaces to intimately mate and become acoustically transparent which improves the energy transfer. We recommend Dow–Corning #4 (or #111 as an alternate). A small packet of Dow–Corning #4 is supplied with the system. If you cannot use a silicon–based grease in your facility, a petroleum–based grease may be used. However, it is likely to leave carbonaceous deposits on the surface, and require more frequent joint maintenance. Grease may be omitted if mylar washers are preferred on systems that require frequent changes. Mylar is plastic and will creep under compression, so mylar is not recommended for system that are not changed frequently. Failure to follow these instructions, may result in the mating surfaces bonding and

NOTE
Always remove a probe stack from the machine in which it is mounted before attaching or removing a horn.



CAUTION
Never leave a horn or booster assembly hand tight. Torque it to the proper specifications before proceeding. If the assembly is installed without being properly torqued down, the assembly may vibrate severely, damaging the mating surfaces and causing the generator to overload.

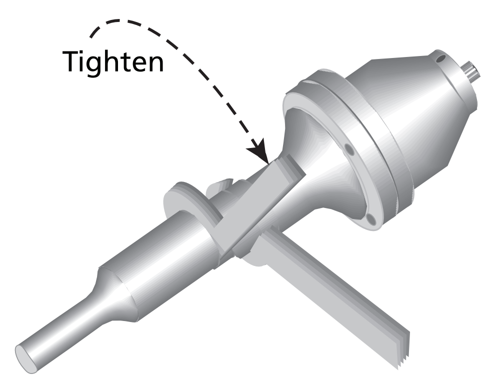


Figure 6–13 Stack Assembly Procedure

difficulty removing the horn from the booster or the booster from the probe.

6. Thread the components together and tighten to the following torque specifications using only the correct size wrenches. Use spanner wrenches on components with spanner wrench holes or an open end wrench on components with wrench flats. See Figure 6–13 for the correct procedure. Refer to Table 6—III for torque units conversions. Be careful not overtighten.
    - 40kHz Stacks - 130 inch-lbs
    - 20kHz Stacks - 200 inch-lbs

inch–lbs	ft–lbs	N–m
130	10.8	14.7
200	16.7	22.6

Table 6—III Horn/Booster Torque Unit Conversions

> **NOTE**
> Horn and booster torque specifications are higher than stud torque specs. Be sure to tighten the horn or booster joints to the higher torque limits.
> Do not tighten the studs to these higher ratings as it may induce unnecessary stress in the assembly.

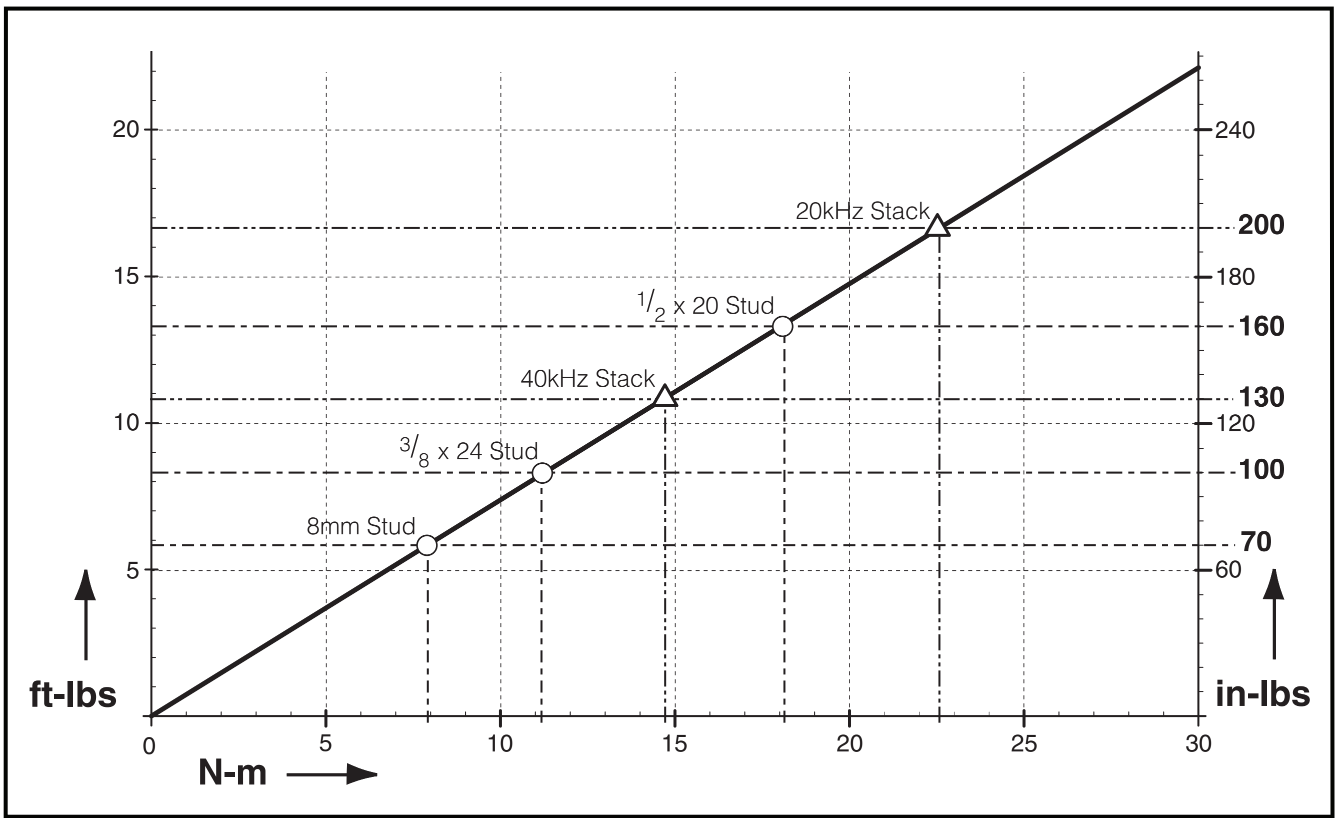


Figure 6–14 Torque Value Conversion Graph

Stack Disassembly

Stack disassembly is required when changing the booster or horn, or for a thorough inspection of all stack components. In mounted systems, always remove the stack from its mounting to disassemble the stack components.

To establish a maintenance schedule, inspect the mating surfaces after the first 200–400 hours of operation. If they require cleaning (see Probe Maintenance in Section 9), halve the time between inspections. If the surfaces do not require reconditioning, then double the time between inspections. Each system is different due to the large number of operational parameters and stress factors.

> **CAUTION**
>
> Never hold a probe by the housing when tightening or loosening an adjoining component. The probe housing has anti–rotation devices to keep the transducer aligned. These could shear under excessive torque.

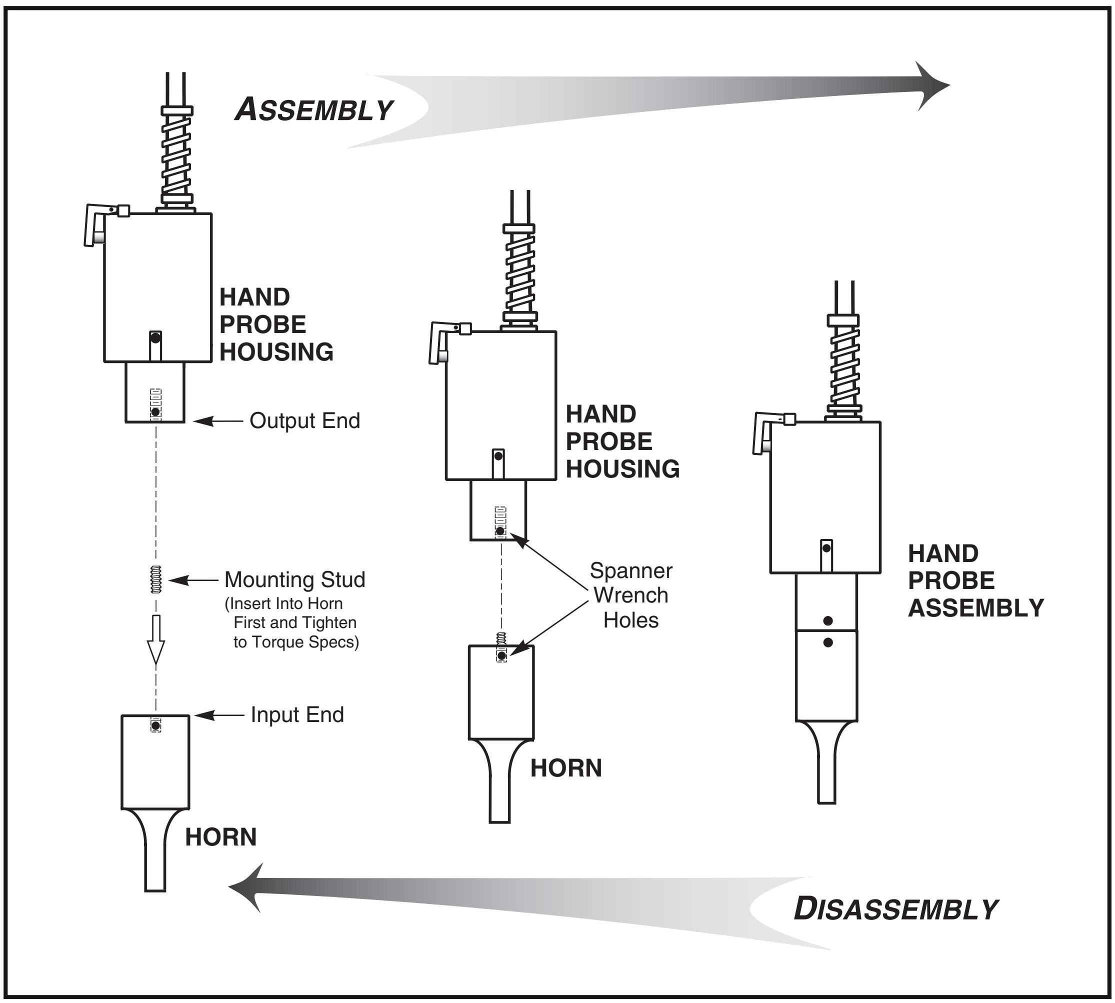


Figure 6–15 Hand Probe Assembly and Disassembly

The assembly and disassembly procedures for a hand probe shown in Figure 6–15. The same procedure for a probe stack with booster is shown in Figure 6–16. It makes no difference whether the horn is attached to the booster first, or the booster is attached to the probe first.

CAUTION

Never hold a probe by the housing or a booster by the mounting rings when tightening or loosening an adjoining component. The probe housing and booster rings have anti–rotation devices to keep the transducer and booster aligned and could shear under excessive torque.

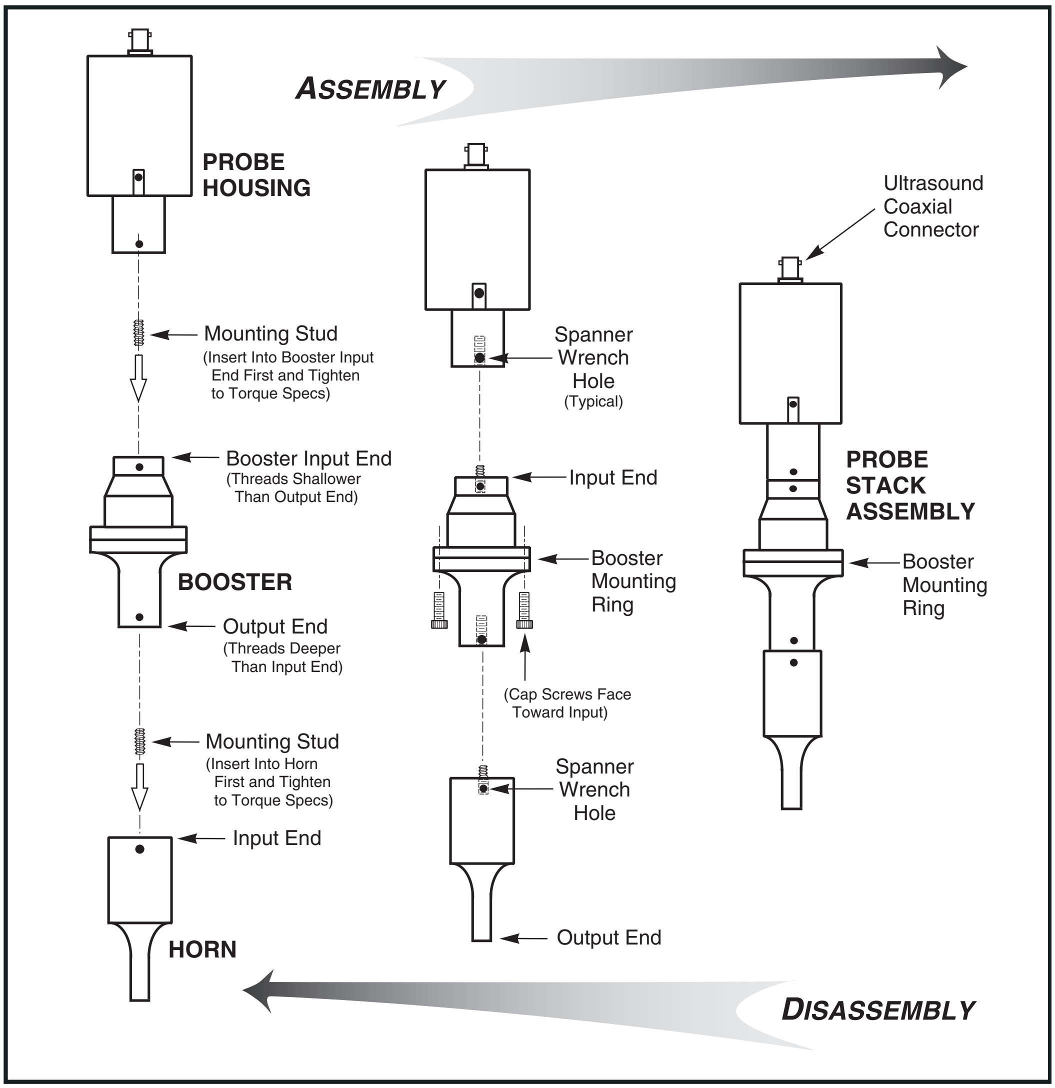


Figure 6–16 Probe Stack with Booster Assembly and Disassembly

Separating The Horn From A Booster, Booster From A Probe Or Horn From A Probe

On all transducers and horns with spanner wrench holes (see Figures 6–17), use only the correct size spanner wrench that came with your system to provide sufficient torque to loosen a joint.

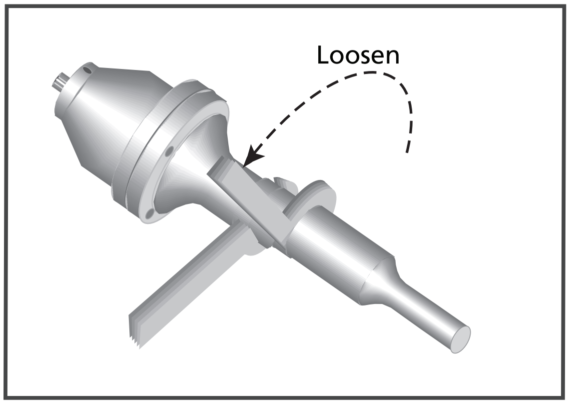


Figure 6–17 Separating The Horn From The Booster

On boosters and horns with wrench flats, use only the correct size wrench to provide sufficient torque to loosen a joint when necessary.

Removing The Mounting Stud From A Horn Or Booster

Only use an allen wrench of the correct size in the socket head of stud to remove the stud from the horn or booster.

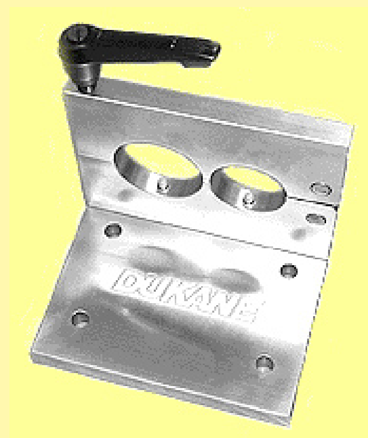
Removing Replaceable Tips From A Horn

Use an open end wrench of the correct size to fit the wrench flats of the detachable tip. Use a spanner wrench (on horns with spanner wrench holes) or an open wrench (on horns with wrench flats) to provide an opposite force and keep the horn from turning in your hand. Refer to Figure 6–18 for the correct tip removal procedure.

CAUTION

NEVER clamp a horn or booster in a vise. The resulting scratches or gouges in the surface are stress risers which may result in cracks.

Dukane has a stainless steel tool vise (Part No.UFTV20) for clamping 20kHz boosters and transducers to facilitate disassembly of stubborn components without damage. It accepts transducer and booster tooling diameters of 1.5 and 1.81 inches and has replaceable anti-rotation pins.



NOTE

Do not hold a booster by the mounting rings when removing the stud from the booster. Use a spanner or open–end wrench to provide opposite force and keep the horn or booster from turning in your hand when loosening the stud. Use a spanner wrench on horns and boosters with spanner wrench holes. Use an open end wrench on horns and boosters with wrench flats.

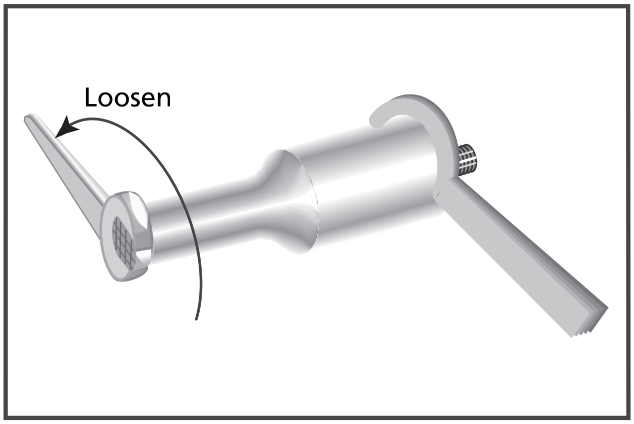


Figure 6–18 Removing A Replaceable Tip From The

Booster Notes

How To Tell The Booster Input End From The Output

1. The depth of the threaded hole on the output end is always deeper than the threaded hole on the input end.

2. On an amplifying booster (gain > 1.0), the larger diameter end is the input end. On a reducing booster (gain < 1.0) the larger diameter end is the output end. On a neutral acting booster the diameters are equal.

3. The cap screws on the booster mounting rings are always inserted from the output end toward the input end (see Figure 6–16).

How To Tell If The Booster Is Amplifying Or Reducing

Boosters have a die-stamped number on their surface that indicates their gain or reduction. If the number is greater than 1.0 (e.g. 1.5), it is an amplifying booster. If the number is less than 1.0 (e.g. 0.6), it is a reducing or reverse booster. A neutral booster has no gain and has 1.0 stamped on it. A neutral or coupling booster is used to provide another probe stack clamping location for added stability.



CAUTION

NEVER install a booster upside down to change an amplifying system to a reducing system. The boosters are dimensionally asymmetric. They are tuned from input to output to act like an acoustic lens. Reversing them will not give the expected results and may cause damage to the system.

Mounting The Stack

A probe-horn assembly or probe-booster-horn assembly (stack) can be mounted into a customer-provided machine to ensure stability and proper alignment during operation or for automated operation. A stack is secured in a machine by clamping the probe (and booster, when present) at designated locations. Clamping at these designated locations provides stability to the stack and at the same time does not interfere with the transmission of ultrasonic vibrations of the stack components. The following rules apply when mounting a probe system stack.

1. A probe may be clamped anywhere along its body (except the 41S30). If it has a side mounted BNC, then it may require a thin mounting ring if it is to be clamped near the top. It may also be clamped below the BNC connector.
2. Secure a probe-horn stack by clamping the probe in two places.
3. Secure a probe-booster-horn stack by clamping the probe in one place and the booster in one place.
4. Never clamp the horn.

NOTE

Never hold a probe by the housing or booster by the mounting rings when tightening or loosening from an adjoining component (see Figures 6–15 and 6–16 to identify these parts). Always use the proper spanner wrenches when tightening or loosening the horn or booster.

DPC Checkout

- Startup & Self–Test
- System Test
- Probe Operation
- Stopping the Weld Cycle

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Startup and Self–Test

1. Push the rear panel AC breaker switch to the ON position (see Figure 3–3 or 3–9 for the switch location.)
2. Push the front panel AC power switch to the ON position (marked I on the switch.) This is labled A in Figure 7–1.

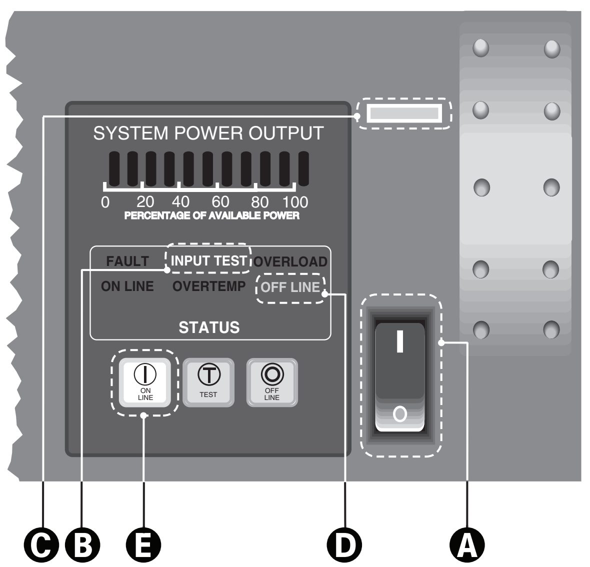


Figure 7–1 Front Panel Startup Controls and Indicators

3. The INPUT TEST indicator in the Status Display (B) flashes red for 5 to 10 seconds. This indicates the power-up self test is running. When the test has successfully completed, the INPUT TEST indicator goes dark.
4. The green power indicator (C in Figure 7–1) should then light up. The yellow OFF LINE status indicator (D in Figure 7–1) should also be lit. After subsequent power cycles, the DPC will return to its last state (ON LINE or OFF LINE) when the front panel AC power switch is turned ON again.
5. Press the ON LINE generator control key on the front panel (labeled E in Figure 7–1.) The green ON LINE indicator in the Status Display (labeled F in Figure 7–2) should now be lit.

> NOTE
> If either of the AC Breakers open, they will flip the switch to its Off position marked by the

> NOTE
> If the **INPUT TEST** indicator does not flash, check the AC line input. Both the rear panel and front panel AC breaker switches must be in the ON position, and the DPC line cord must be properly connected to a live AC outlet.
>
> If the **INPUT TEST** indicator flashes and then remains in a steady red state –
> 1. The AC line level may be out of speci- fied operating range.
> 2. The DPC may have an internal fault preventing normal opertion.

> NOTE
> If a Press Control module is installed, and the ON LINE and OFF LINE indicators do not light, check the follwoing items.
>
> 1. A Press Base cable (P/N 200–1124) must be connected to J35 on the press and J902 on the DPC (Cable 3 in Figure 3–8).
> 2. The Emergency Stop switch must be in its reset position (pulled out).
> 3. In place of a press cable, a jumper block (Dukane P/N 200–1293) can be installed on J902 (see Figure 3–4).

DPC System Test

To test the DPC II system's ultrasound signal delivery, perform the following steps.

1. For the initial test, the generator must be ON LINE. Refer to step 5 on the previous page.
2. Position the probe so that its horn is not in contact with anything. Do not hold the probe if you are not accustomed to ultrasonic welding. The initial ultrasonic sensation may surprise you and cause you to drop the probe. Momentarily press the generator control TEST key (G in Figure 7–2). The following conditions should occur.

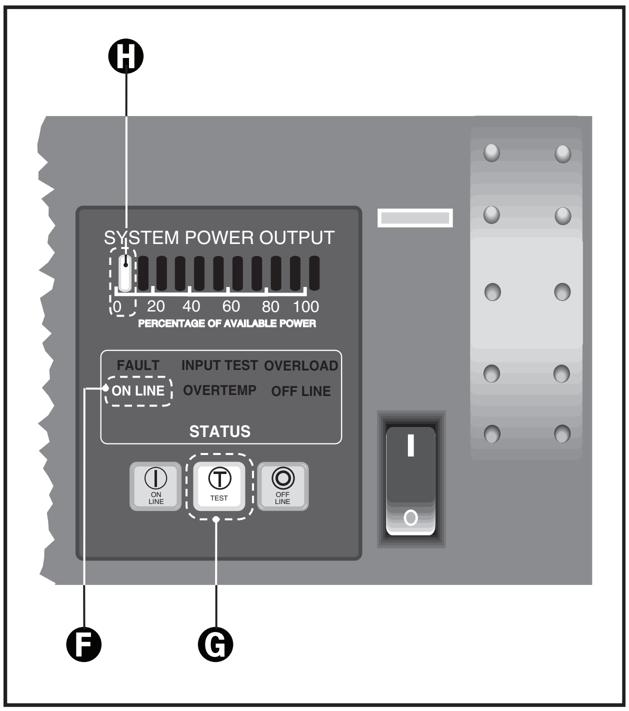


Figure 7–2 System Test Controls and Indicators

3. One green segment of the System Power Output bar display will light up indicating normal operation (H in Figure 7–2.)
4. The ON LINE status indicator goes blank. This indicates the ultrasonic probe is activated. The probe should operate without any unusual noise. The probe will operate as long as the TEST key is pressed.
5. When the TEST key is released, the ON LINE status indicator lights up again and the Power Output display goes blank.

> **NOTE**
> Neither a press system, automation system, hand probe or TEST key can trigger the generator to produce an ultrasound output if the DPC II Plus is OFF LINE.
>
> The Front Panel Control Lock will disable the TEST key from producing an output. Refer to Section 5, Table 5—IA or 5—IB.

System Operation

1. If the generator is not online, press the ON LINE key. This is labeled E in Figure 7–1. The green ON LINE status should light up (F in Figure 7–2).
2. Apply the probe to the components to be ultrasonically joined, and press the probe's activation switch, or press the palm switches on the press base. In automation systems, the customer supplies external controls to trigger the generator.
3. The Power Output display will light up to indicate the percentage of power being delivered to the probe while the trigger switch is engaged.
4. The Power Output display should never reach 100% during normal operation.
5. The Power Output display should go blank indicating zero output power, after the probe trigger is released.



CAUTION

Any unusually loud noise from the probe stack indicates that it has been improperly assembled. Check the probe stack for proper assembly and correct torque readings.

Stopping the Weld Cycle

Hand Probe System

Release the trigger switch on the hand probe to stop the welding cycle.

Automated System

The customer-supplied external controls provide the means to stop the welding cycle for an automated system.

Press System

Push in the Emergency Stop button on the press base to stop the welding cycle.

End of Day

Push the OFF LINE generator control key on the front panel (I in Figure 7–3).
The yellow OFF LINE status indicator (J in Figure 7–3) should be illuminated.

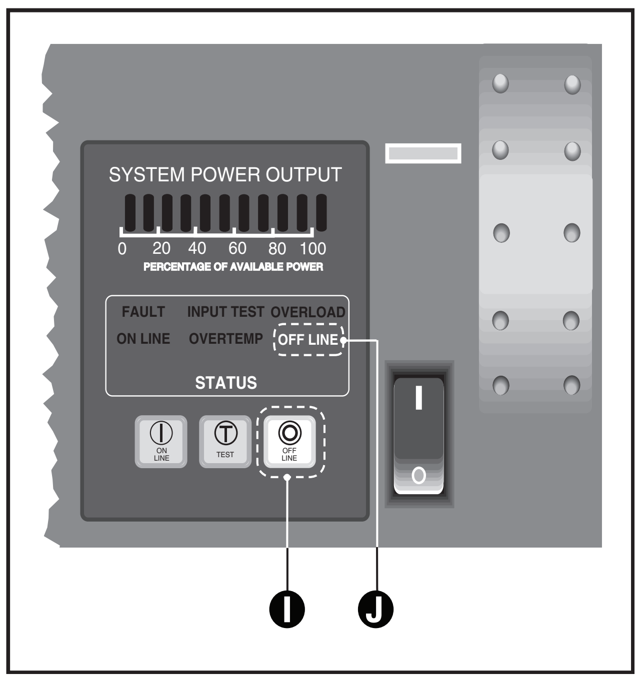


Figure 7–3 Stopping the Weld Cycle

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SECTION 8

Troubleshooting

- No Ultrasonic Output
- Generator Faults
- INPUT TEST Indicatorr
- TEST Control Key
- Troubleshooting Flowchart

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No Ultrasonic Output

Probe

Make sure that the probe coaxial cable is connected to the generator Ultrasonic output connector J1 (see Figure 8–1). Make sure the probe stack was assembled following the instructions in Section 6.

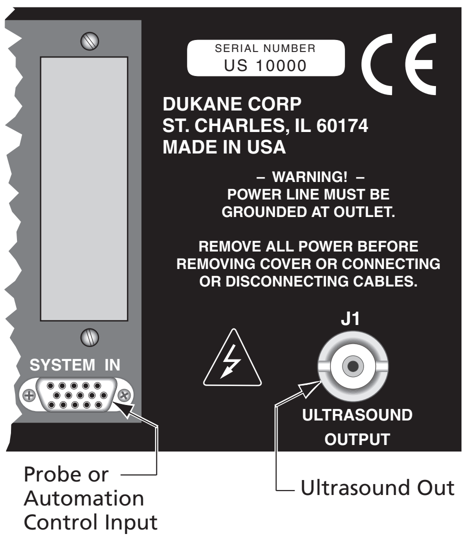


Figure 8–1 Rear Ultrasound and System-In Connectors

Cables

Make sure that both the U/S coaxial and Control Input cables are connected. You must have a trigger input to the SYSTEM IN HD-15 connector either by the probe's control cable or custom automation. Refer to Figures 3–4 through 3–8 for details. Put the generator OFF LINE and turn off the AC power switch. Check the coaxial cable for any signs of damage which may result in an open circuit preventing the cable from transmitting the signal from the generator to the probe. If you have a mounted probe, replace the coaxial cable with a known good cable. If you are using a hand probe, try a different known good probe to determine if the problem is related to the generator or external cables and probe.

CAUTION

Always turn the AC power off and wait a few seconds, before disconnecting or connecting any cable to the DPC. Failure to turn off the AC power may result in damage to the generator or probe.

Generator

The generator will not produce an output signal when triggered if it is OFF LINE. Make sure that the green power indicator [A] is lit. The status display should indicate ON LINE which is marked as [B] in Figure 8–2. If the generator is OFF LINE, press the ON LINE control key [C].

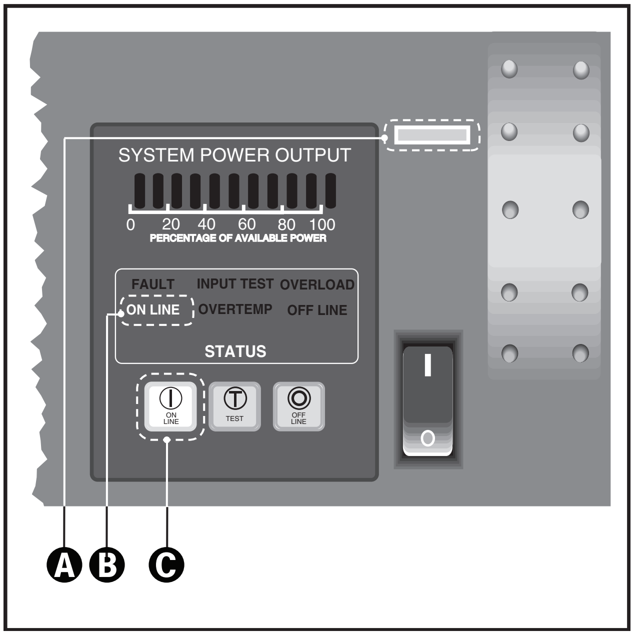


Figure 8–2 Generator ON LINE Key and Indicator

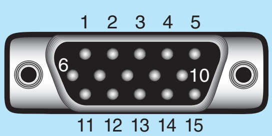
Operate Input

If you are using a hand probe, make sure the control cable is connected to the System Input connector. The trigger on the hand probe activates the Ultrasonic output through the control cable.

If you have supplied custom automation signals, pin 8, or pins 3 & 4 of the Operate Input must be used to trigger the Ultrasonic output. The system control inputs are user configurable on a DPC II equipped with a Rev–1 motherboard. Refer to Section 5, Jumper Block SH707 for a detailed description of the options. The factory default setting (JU724) is a contact closure to ground. If you are using the isolated source jumper position (JU726), then the input requires a minimum of 5V to trigger the generator.

NOTE

The System In connector pinout shown in Figure 5–2 is a female panel connector. The cable end connector is a mirror image of the rear panel connector. Figure 5–3 is repeated here and shows the male cable end. Make sure you have correctly wired the connector if you are using custom automation signals.



Generator Faults

OVERLOAD

If the generator OVERLOAD light comes on, it indicates excessive power is being drawn. This could be caused by a mismatch between the ultrasonic signal and the resonant characteristics of the acoustic stack. Improperly assembled probes may draw excessive power if their components were not properly torqued to specifications. Make sure you have the correct probe and horn. A 40kHz probe connected to a 20kHz DPC may result in an instantaneous overload. The same is true for the reverse combination. Excessive power drawn by the load may result in damage to the probe and horn.

OVERTEMP

If the OVERTEMP indicator comes on, it indicates that one of the generator's power modules has overheated. This may occur due to a cooling fan failure or excessive dust inside the cooling channel. The module's temperature sensor will automatically shut down the generator. The generator will automatically reset and turn off the OVERTEMP indicator when the module temperature drops below the 75°C (167°F) trip point.

FAULT

If the generator FAULT light comes on, it indicates an out–of–tolerance voltage condition. This could be related to one of two conditions.

1. AC line voltage out of tolerance. Refer to Table 11—I for the AC voltage specifications.
2. Internal DC power supply problems (+5VDC, +12VDC, –12VDC or +24VDC).

   If the AC line voltage is within tolerance, then the DPC has an internal fault. Contact your local Dukane representative.

> **NOTE**
> The OVERLOAD, OVERTEMP and FAULT indicators are triggered by independent sensors. It is possible to get more than one error indicator. The ultrasonic output is disabled on any one of the errors.

Generator Errors

INPUT TEST Indicator

Steady Red

During power up, the INPUT TEST indicator should flash red for 5–10 seconds. This indicates the power-up test is running. When the test has successfully completed, the INPUT TEST indicator goes out. If the INPUT TEST indicator flashes and then remains in a steady red state, there are two possible causes.

1. The AC line level may be out of the specified operating range. Check the AC power to determine if it is within the limits specified in Section 11 (Table 11—I).
2. If the AC power is within specifications, the DPC has an internal circuit fault preventing normal operation. Contact your local Dukane representative.

Does Not Flash

If the INPUT TEST indicator does not flash during power up, check the AC line input. Both the rear panel and front panel AC breaker switches must be in the ON position, and the DPC line cord must be properly connected to a live AC outlet. The generator will not turn on if the line voltage is below the rated minimum. The INPUT TEST indicator should light up even without a probe connected.

TEST Control Key

The TEST key should cause the first green bar on the power display to light even without a probe (see DPC System Test in Section 7 and Figure 7–2). If the TEST control key will not trigger the INPUT TEST light, check that the FP Lock of the System Input is not grounded. A contact closure between this pin and ground (pin 2 or 7) will lock out the front panel TEST key. Refer to Table 5—IA/5—IB for the correct pin number.

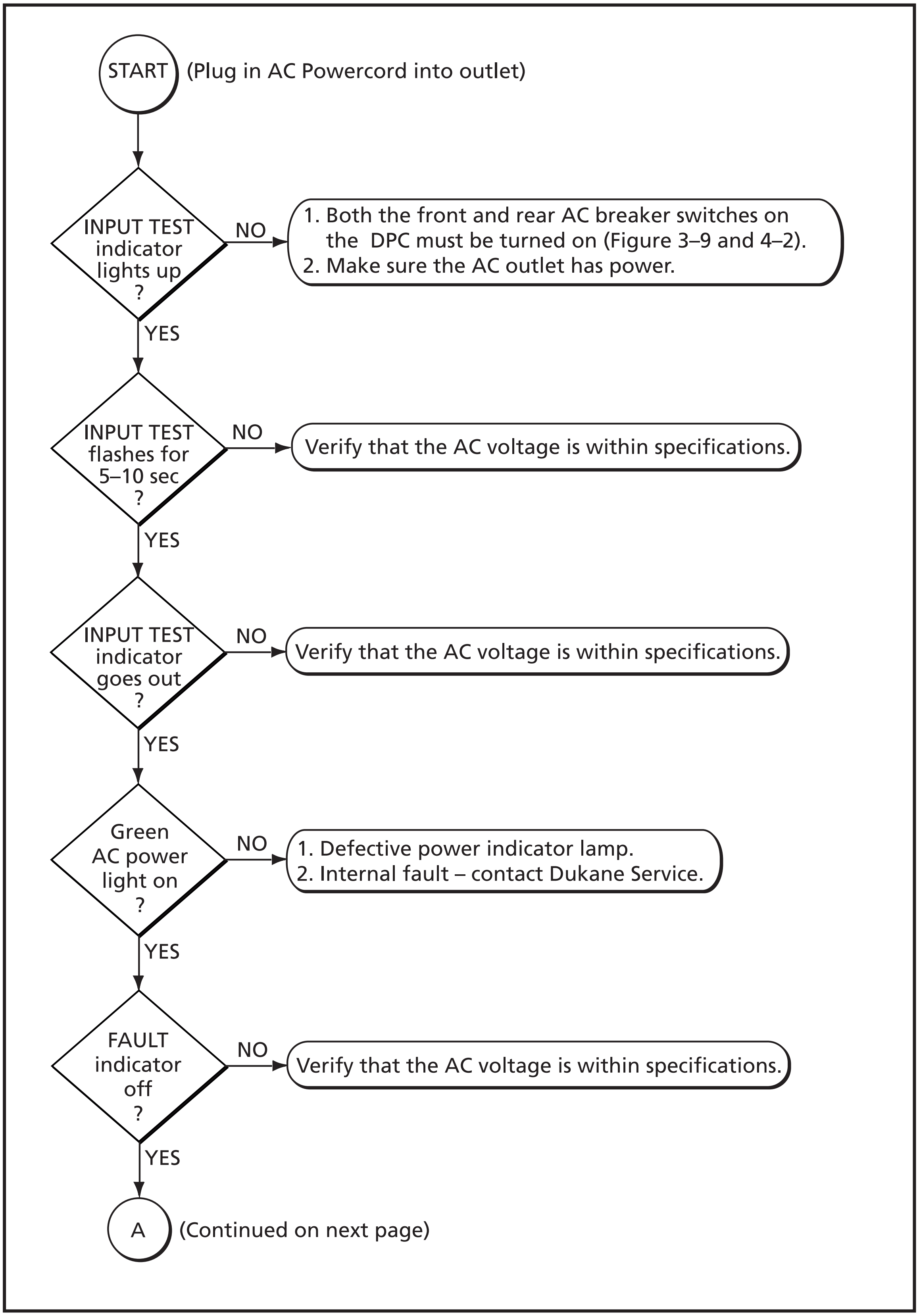


Figure 8–3 Troubleshooting Flowchart – Part 1

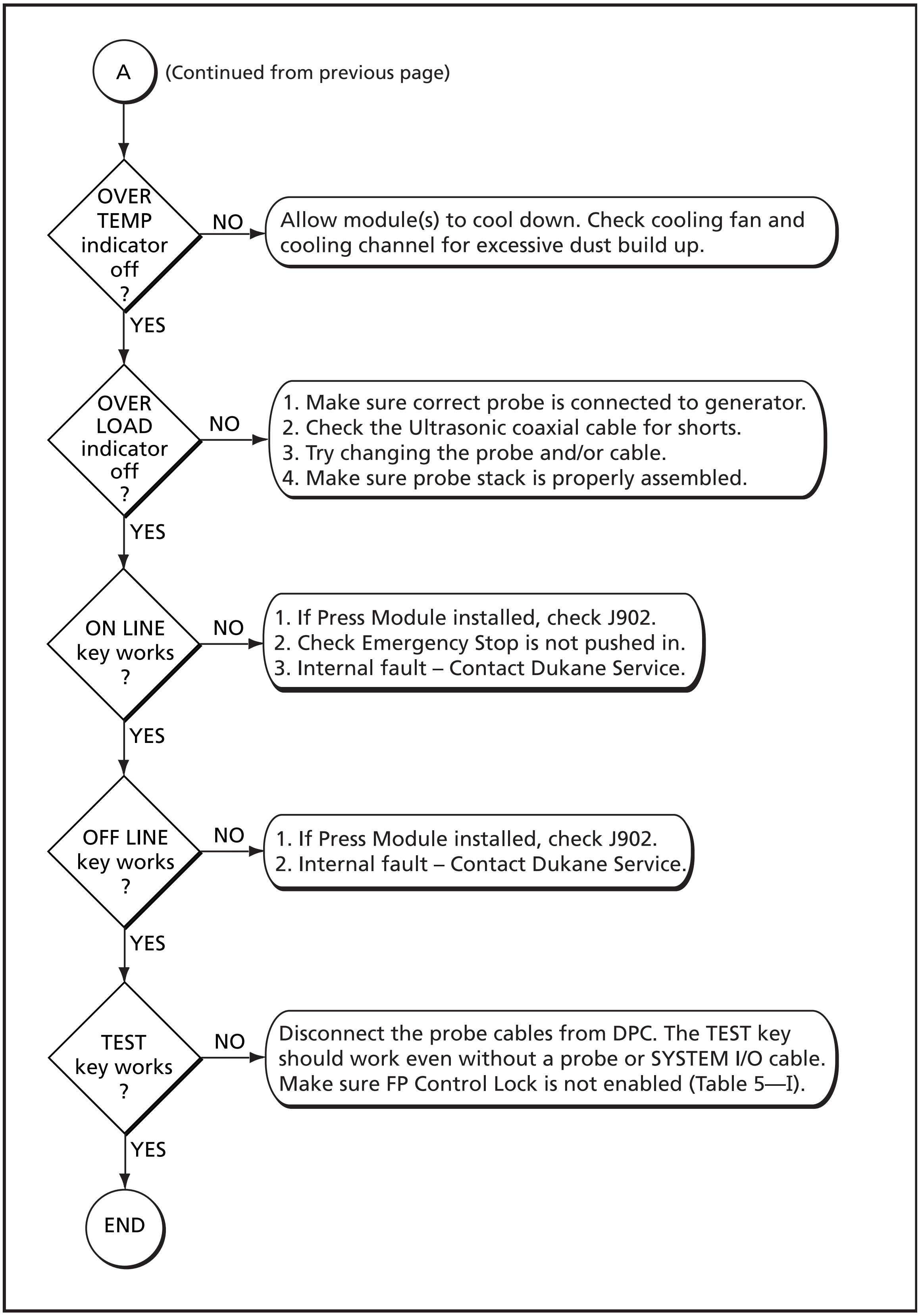


Figure 8–4 Troubleshooting Flowchart – Part 2

Care & Maintenance

- Front Panel
- Rear Panel
- Chasis
- Probes
- Reconditioning

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Front Panel

Cleaning

Do not use any solvents or abrasive cleaners on the front panel. Do not spray cleaner directly onto the front panel. Apply a small amount of computer cleaner to a soft towel first. Clean the panel with the moistened towel. Do not spray or apply the cleaner directly to the DPC. Do not allow any liquid to collect around the AC power switch.

Control Keys

Use your finger to press the control keys. Do not use sharp objects on the keys. If your hands are greasy or contaminated with dirt, use a soft object like a pencil eraser to push the keys.

Rear Panel

Connectors

The rear panel System Input and Status Output each have a pair of 4-40 threaded nuts to secure the connectors. Do not overtighten them

AC Power Cord

The AC power cord should be kept in good condition and free from any cuts. The AC plug should be straight with no bent prongs.

Grounding Stud

The rear chassis earth ground connection (see Figures 2–5 and 3–3) is a 10–24 x 1/2" threaded stud. The ground wire should be securely attached to the chassis, but do not overtighten the nut.

Chassis

Side Ventilation Slots

Keep the two side ventilation slots free from obstructions. If excessive dust or dirt collects on the slots, wipe or vacuum them clean. Do not use compressed air to clean them as this may force the dirt inside the chassis. The right hand slot (when viewed from the front) is the air intake and the left hand side is the exhaust. Allow at least 2 inches (5 cm) on either side for air circulation as shown in Figure 9–1.

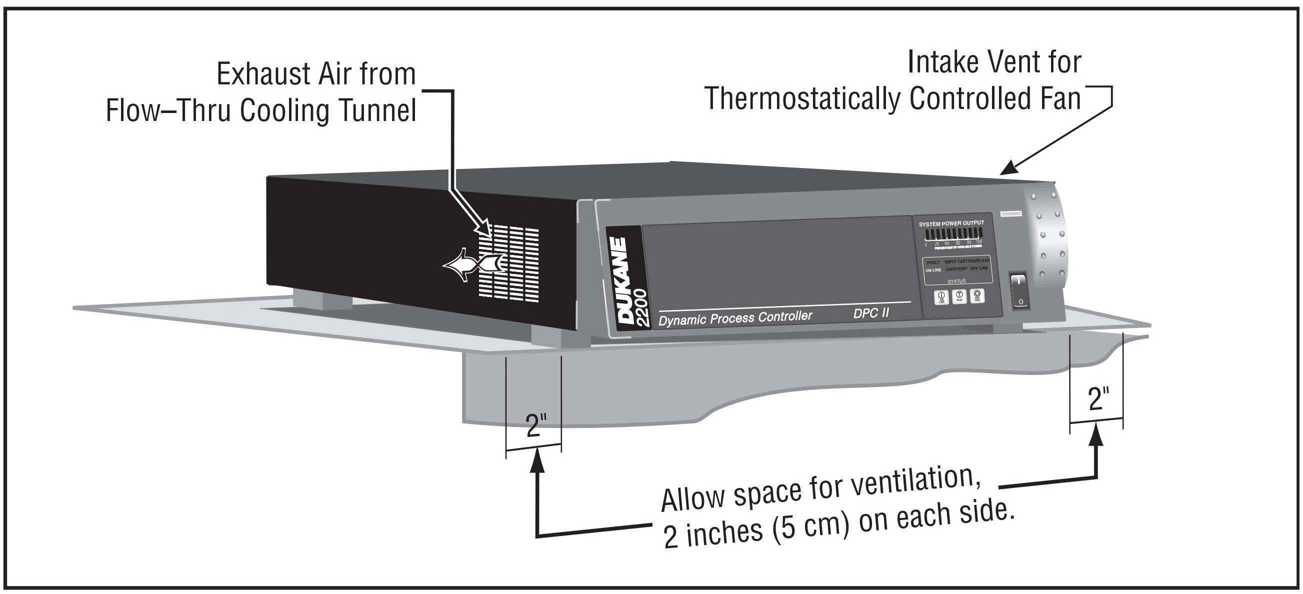


Figure 9–1 Location of DPC Air Cooling Vents

Top Cover

Keep the cover on during operation. The chassis is robust enough to hold considerable weight. However, avoid placing excessively heavy objects on top of the chassis which may bend or dent the top cover resulting in damage to internal components.

Replaceable Parts

The DPC is self contained and has no parts that are replaceable by the user. If a part needs replacement, contact your local Dukane representative. See Section 10 for contact information.

Stack Surfaces

Stack Maintenance

It is essential that the mating surfaces of the acoustic stack components be flat and smooth. When the components are joined together and tightened, there must not be any air gap between the surfaces.

If there is any air gap , there will be a loss in power and efficiency. Air has much higher transmission losses than the metal horn. Whenever the wavefront encounters an air gap, the propagation velocity is significantly reduced and attenuated. This results in considerable loss. In some cases, the union between the mating surfaces could be so poor as to prevent the probe stack from operating. This could result in excessive power drawn from the generator and may damage the mating surfaces. Figure 9–2 shows the mating surfaces on a typical probe and booster assembly.

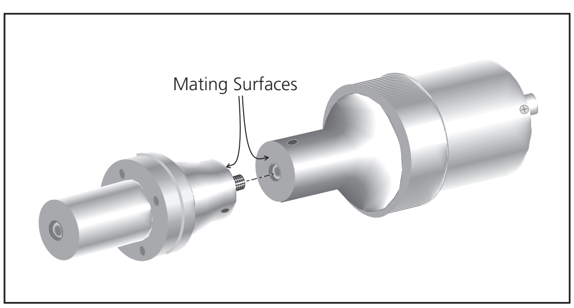


Figure 9–2 Location of Stack Mating Surfaces

Stack Inspection

Examine the mating surfaces of the horn and probe (and booster if applicable). Look for a shiny, burnished area. This indicates where the surfaces have been in contact. It will indicate whether the surfaces are flat and making good contact, or if they are uneven and making poor contact.

Inspection Schedule

To establish a maintenance schedule, inspect the mating surfaces after the first 200–400 hours of operation. If they require cleaning, halve the next inspection time. If the surfaces do not require reconditioning, then double the next inspection time.

Surfaces with Even Contact

A flat surface will make even contact and its surface will be evenly burnished across the entire contact area. Figure 9–3 shows a surface that has made even contact.

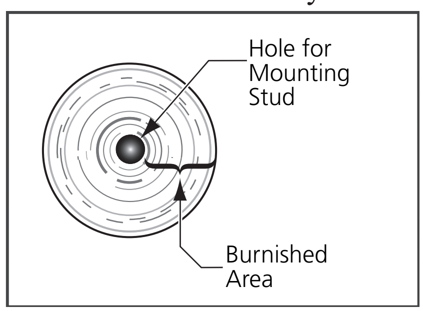


Figure 9–3 Flat Surface With Even Contact

Surfaces with Uneven Contact

A surface that is not completely flat will make uneven contact. Its surface will be burnished only in the area where it has made contact. Figure 9–4 shows what such a surface would look like. The inner and outer areas have no marks on it indicating there has been no contact in these areas.

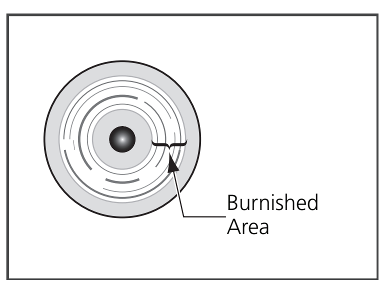


Figure 9–4 Flat Surface With Uneven Contact

Crowning

A surface which is burnished only in the inner ring area around the stud, indicates the surface is convex or crowned. An example of this is shown in figure 9–5. To get an idea of amount of deviation from a flat surface, place a straight edge along the stack element. Since its surface is higher at the center than at the edges, there will be a gap at the outer edge of the element.

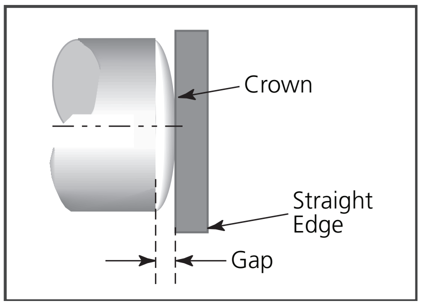


Figure 9–5 Crowned Surface

Center Depression

A surface which is burnished only in the outer ring area around the edge, indicates the surface is concave or depressed. An example of this is shown in figure 9–6. To get an idea of amount of deviation from a flat surface, place a straight edge along the stack element. Since its surface is higher at the edge than at the center, there will be a visible gap near the center indicating the depth of the depression.

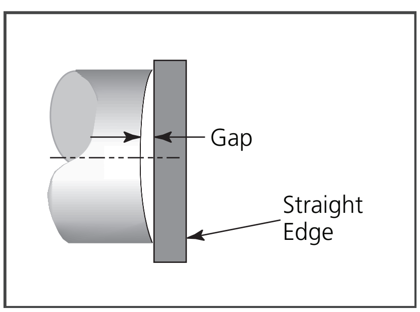


Figure 9–6 Center Depression

Corrosion

Corrosion is a factor to consider when determining the overall system performance. Over time, corrosion can build up on the mating surfaces of the acoustic stack. This build up interferes with the efficient transfer of ultrasonic energy to the parts to be welded. It may contribute to a loss in performance. Evidence of corrosion build up includes discolored mating surfaces or surfaces encrusted with hard deposits. To extend equipment life and maintain performance levels, minimize the system's exposure to corrosive sources.

Reconditioning

Overview

Stack components require reconditioning when the mating surfaces become uneven or corroded. These conditions cause poor contact between the mating surfaces which wastes power. It also makes tuning the stack difficult, can cause heat damage to the transducer, and can contribute to a higher system noise level.

Machining the Mating Surfaces

Instructions on how to properly machine the stack components is beyond the scope of this manual. Please call Dukane's Tooling Support Team for machining information. A list of Dukane contacts is provided in Section 10.

Manual Resurfacing

To manually resurface the stack component mating surfaces, follow the steps given here.

1. Disassemble the acoustic stack and wipe all the mating surfaces clean. Use a clean cloth or a paper towel.
2. Examine all the surfaces. If any are corroded, discolored or coated with hard deposits, they should be reconditioned.
3. If the surfaces appear to be in good condition, proceed to step 11.
4. Remove the mounting stud(s) if any are installed.
5. Tape a clean sheet of #400 grit (or finer) emery cloth grit side up to a clean, flat surface such as a piece of plate glass.
6. Hold the stack component with one hand near the bottom as shown in Figure 9–7. This view shows the thumb covering one of the three spanner wrench holes.

NOTE

Before deciding to recondition the mating surfaces yourself, consider calling Dukane Corporation's Tooling Support team to discuss the situation. This is especially important if the mating surfaces are uneven, because machining of the component(s) may be required. Factory personnel can offer their skills and experience to help you determine the options for your particular needs.

See Section 10 for a list of Dukane contacts.

CAUTION

An improperly altered horn can cause destructive stress to the transducer, booster, generator and horn. The horn should only be modified by Dukane's Horn Department.

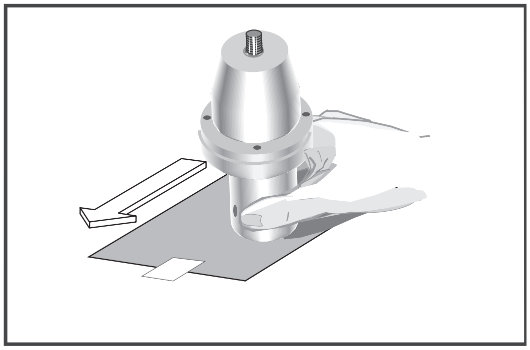


Figure 9–7 Manual Resurfacing

Without applying any downward pressure, carefully stroke the part **in one direction** across the emery cloth. The component's weight alone is enough pressure as the part is moved across the emery cloth. Complete a second stroke across the cloth just like the first.

7. Keep the element's surface flat against the emery cloth and turn it 120° (one–third of a complete rotation) so the thumb covers the next spanner wrench hole. Again move the part twice across the emery cloth as covered in the previous step.
8. Give the part a final one–third turn and repeat the two strokes described in Step 6.
9. Reexamine the mating surfaces. Repeat Steps 6 through 8 until the corrosion has been removed.
10. Clean any grit from the resurfaced element and the stud mounting threads using a clean cloth or paper towel.
11. If you had to remove the mounting studs, they need to be reinserted. Before they are reinserted, it is necessary to ensure proper thread engagement.
    a. Inspect and clean the stud.
    b. Clean the threaded hole with a clean cloth.
    c. Thread the stud into the hole. Tighten the stud to the torque specifications given in Table 6—III.
12. Reassemble the stack and install it using the procedure in Section 6 using Figures 6–6 and 6–7 as guides.
13. Complete the Operational Test in Section 7.

CAUTION

Use extreme care to keep the part level when moving it across the emery cloth. Be careful not to tilt the part. An uneven mating surface could leave the mating surface inoperative.

Surface flatness is more important than surface finish.

CAUTION

It is important to perform only two strokes each time the component is rotated. Performing more than two strokes affects whether the surface remains flat. It is important for the mating surface to maintain its perpendicularity in relationship to the component's centering axis. If this relation between the surface and the axis is altered, the welding system may become inoperative.

NOTE

If the studs are overtightened, the threads may deform. Removing a stud that has been overtightened could damage the threads in the horn/booster. If this should happen, retap the horn/booster threads and replace the stud with a new one.

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Contacting Dukane

- Corporate Office
- Extensions & eMails



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Contacting Dukane

Identify Equipment

When contacting Dukane about a service–related problem, be prepared to give the following information:

- Model number, line voltage and serial number.
- Any fault indicators from the DPC status display.
- Problem description and steps taken to resolve it.

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Intelligent Assembly Solutions

Mailing Address: Dukane Ultrasonics
2900 Dukane Drive
St. Charles, IL 60174 USA

Phone: (630) 797–4900

Fax:

Main (630) 797–4949

Service & Parts (630) 584–0796

Website

www.dukane.com/us

The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature.

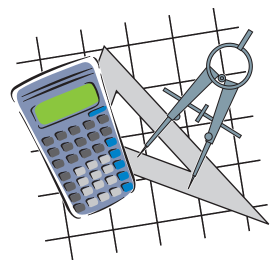
You can locate your local representative at:

www.dukane.com/us/sales/intsales.htm

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Specifications

- Regulatory Compliance
- Dimensions
- Power Requirements and Model Ratings



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Regulatory Agency Compliance

FCC

The equipment complies with the following Federal Communications Commission regulations.

- The limits for FCC measurement procedure MP-5, “Methods of Measurement of Radio Noise Emissions from ISM Equipment”, pursuant to FCC Title 47 Part 18 for Ultrasonic Equipment.

CE Marking

This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Europeéne (European Conformity). The equipment complies with the following CE requirements.

- The EMC Directive 2004/108/EC for Heavy Industrial —
  EN 61000-6-4: 2001
    EN 55011: 2003
  EN 61000-6-2: 2001
    EN61000–4–2
    EN61000–4–3
    EN61000–4–4
    EN61000–4–5
    EN61000–4–6
    EN61000–4–8
    EN61000–4–11
- The Low Voltage Directive 2006/95/EC.
- The Machinery Directive 2006/42/EC.
    EN 60204: 2006
      Safety of Machinery - Electrical Equipment of Machines Part 1: General Requirements.

CAUTION

DO NOT make any modifications to the DPC or associated cables as the changes may result in violating one or more regulations under which this equipment is manufactured.

Dimensions

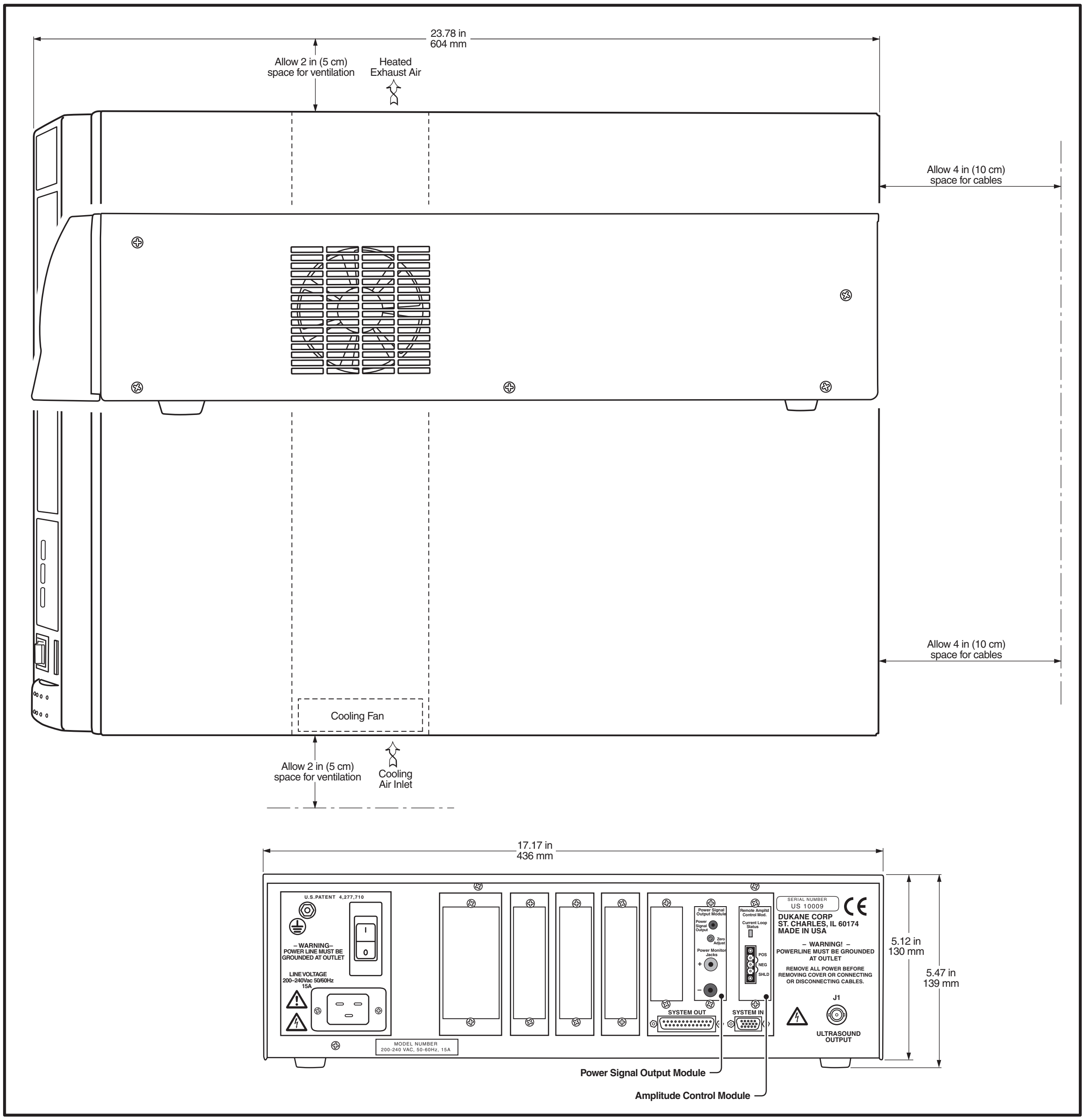


Figure 11–1 DPC II Generator 3–View and Dimensions

Operating Environment

Operate the DPC II Plus within these guidelines:

Temperature: 40°F to 100°F (+5°C to +38°C)

Pressure: Ambient

Air Particulates: Keep the DPC dry. Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% Non–condensing @ 0°C to +30°C

Vibration: 1.0 G

Storage guidelines:

Temperature: -4°F to 158°F (-20°C to +70°C)

Humidity: 5% to 95% Non–condensing @ 0°C to +30°C

Vibration: 2.5 G

AC Power Requirements

The AC power requirements depend on the frequency and power rating of the DPC II. Table 11—I below, lists both the nominal AC requirements (maximum current drawn before overload) and the service rating of the AC outlet each model of the DPC II is designed for.

Frequency	DPC II Model No.	Peak Power Rating (Watts)	Nominal AC Power Requirements	AC Outlet Current Rating
15 kHz	1400	4000	190–260V 50/60 Hz @ 30 Amps	30 Amps
20 kHz	2050	500	95–130V 50/60 Hz @ 8 Amps	15 Amps
			190–260V 50/60 Hz @ 4 Amps	15 Amps
	2120	1200	95–130V 50/60 Hz @ 15 Amps	15 Amps
			190–260V 50/60 Hz @ 8 Amps	15 Amps
	2170	1700	190–260V 50/60 Hz @ 12 Amps	15 Amps
	2220	2200	190–260V 50/60 Hz @ 15 Amps	15 Amps
	2300	3000	190–260V 50/60 Hz @ 25 Amps	30 Amps
30 kHz	3150	1500	190–260V 50/60 Hz @ 12 Amps	15 Amps
40 kHz	4035	350	95–130V 50/60 Hz @ 6 Amps	15 Amps
			190–260V 50/60 Hz @ 4 Amps	15 Amps
	4070	700	95–130V 50/60 Hz @ 12 Amps	15 Amps
			190–260V 50/60 Hz @ 8 Amps	15 Amps
	4100	1000	95–130V 50/60 Hz @ 15 Amps	15 Amps
			190–260V 50/60 Hz @ 8 Amps	15 Amps
50 kHz	5015	150	95–130V 50/60 Hz @ 6 Amps	15 Amps
			190–260V 50/60 Hz @ 4 Amps	15 Amps
70 kHz	7010	100	95–130V 50/60 Hz @ 6 Amps	15 Amps
			190–260V 50/60 Hz @ 4 Amps	15 Amps

Table 11—I DPC II Generator Model and Power Supply Requirements

Interpreting the DPC II Model Number

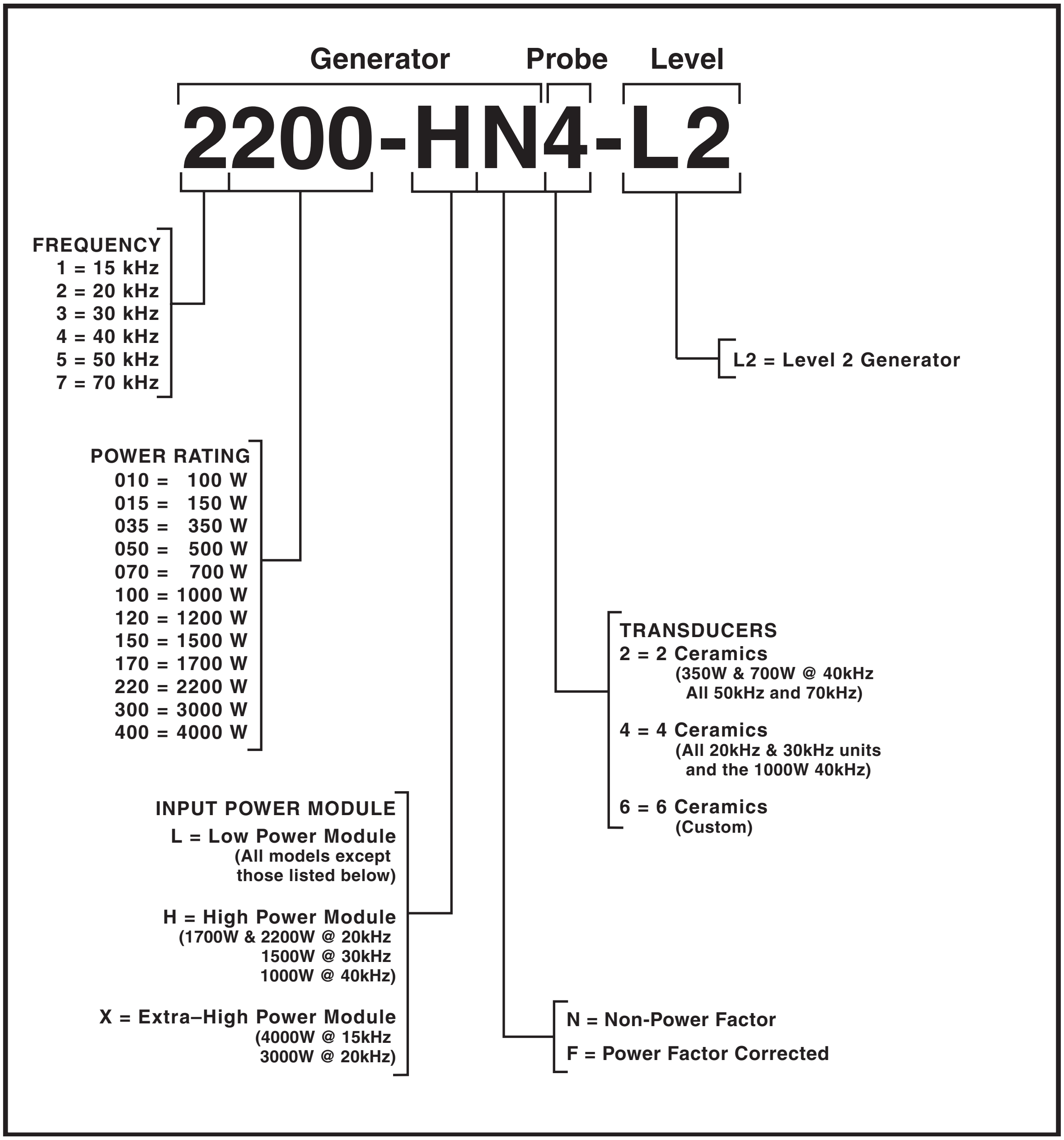


Figure 11–2 Interpeting the DPC II Model Number

> **NOTE**
> Figure 11–2 is designed to help you determine which options your DPC has. It is not meant to suggest that all combinations of these options are possible.

Warranty

- Domestic Warranty
- International Warranty

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DUKANE CORPORATION *36-MONTH WARRANTY, USA, CANADA, MEXICO*

Dukane ultrasonic equipment, when used in accordance with written instructions and under normal operating conditions, is guaranteed to be free from defects in material and workmanship for thirty-six (36) months based on one shift per day, five days per week. Any unit that proves to be defective during the stated period will be repaired free of charge or replaced at the sole discretion of Dukane Corporation, provided the defective unit is returned properly packed with all transportation charges prepaid. A limited warranty as specified may apply to certain components of the equipment, and/or for certain types of applications of the equipment. The warranty period shall commence on the date of original shipment.

This warranty is limited to a one-time only repair or replacement of the transducer or transducer driver during the 36-month warranty period.

This warranty is limited to standard ultrasonic welding systems and shall not apply to equipment subject to misuse, improper installation, alteration, neglect, or accident.

This warranty is limited to the original user and is not transferrable. No warranties expressed or implied have been made other than those stated herein. Dukane Corporation hereby disclaims any warranty of merchantability or fitness for a particular purpose.

No liability is assumed for expenses of damages resulting from interruptions in operation of the product or damages to material in process.

No person, firm, or representative is authorized to assume any obligation or make any warranty on behalf of Dukane Corporation, other than stated above, for equipment used within the continental United States. Alaska, Hawaii, and Puerto Rico are considered part of the continental United States for purposes of this warranty, and Mexico and Canada are covered under this warranty as well.

For Dukane ultrasonic equipment used in areas outside the continental limits of the United States, Canada and Mexico, the user shall have to contact their local Dukane representative or Dukane Corporation, 2900 Dukane Drive, St. Charles, IL 60174, (Telephone: (630) 584-2300) for applicable warranties.

This warranty originated June 24, 1991.

WARRANTY EXCEPTION STATEMENT

This warranty will become void if the welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exeeds one (1) second.

Horns fabricated for use in equipment described in quotations and literature are manufacturred to exacting parameters. The use of altered or modified horns, or horns otherwise unqualified by Dukane, can produce undue stresses that may damage the equipment. Failures of equipment resulting from the use of unqualified horns are not covered by the Dukane warranty. Please contact your Dukane representative or Dukane Corporation, St. Charles, IL, should you have any questions concerning horn qualifications.

Dukane ultrasonic products used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2,000 hours or one (1) year, whichever comes first.

In any application, if transducer overheating or improper cooling of the transducer results in equipment failure, the warranty is void.

Equipment sent from offshore to the United States will carry the International warranty. Equipment sent from the United States to offshore destinations will carry the International warranty.

The warranty will not apply to components that have been subjected to faulty repair, misuse, accident, modifications, or improper installations. Custom systems, horn analyzers, wattmeters, chart recorders, and 400-watt generators are warranted for one (1) year. The warranty period on rentals converted to purchase will run from the initial date of rental (excluding used equipment).

Regarding equipment, components, or parts not manufactured by Dukane or its affiliates, however, this warranty shall be limited in time and extent to the warranty given to Dukane by the original manufacturer. CRTs, LCDs, touch screens (includes the entire MMI), and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty.

(see next page for International Warranty)

DUKANE CORPORATION *12-MONTH WARRANTY, INTERNATIONAL*

Dukane ultrasonic equipment, when used in accordance with written instructions and under normal operating conditions, is guaranteed to be free from defects in material and workmanship for twelve (12) months. Any unit that proves to be defective during the stated period will be repaired free of charge or replaced at the sole discretion of Dukane Corporation, provided the defective unit is returned properly packed with all transportation charges prepaid. A limited warranty as specified may apply to certain components of the equipment, and/or for certain types of applications of the equipment.

This warranty is limited to a one-time only replacement of the transducer during the twelve (12) month warranty period.

This warranty is limited to standard ultrasonic welding systems and shall not apply to equipment subject to misuse, improper installation, alteration, neglect, or accident.

This warranty is limited to the original user and is not transferrable. No warranties expressed or implied have been made other than those stated herein. Dukane Corporation hereby disclaims any warranty of merchantability or fitness for a particular purpose.

No liability is assumed for expenses or damages resulting from interruptions in operation of the product or damages to material in process.

No person, firm, or representative is authorized to assume any obligation or make any warranty on behalf of Dukane Corporation, other than stated above.

This warranty originated June 1, 1992.

WARRANTY EXCEPTION STATEMENT

This warranty will become void if the welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds one (1) second.

Horns fabricated for use in equipment described in quotations and literature are manufactured to exacting parameters. The use of altered or modified horns, or horns otherwise unqualified by Dukane, can produce undue stresses that may damage the equipment. Failures of equipment resulting from the use of unqualified horns are not covered by the Dukane warranty. Please contact your Dukane representative or Dukane Corporation, St. Charles, IL, should you have any questions concerning horn qualifications.

Dukane ultrasonic products used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2,000 hours or one (1) year, whichever comes first.

In any application, if transducer overheating or improper cooling of the transducer results in equipment failure, the warranty is void.

Equipment sent from offshore to the United States will carry the International warranty. Equipment sent from the United States to offshore destinations will carry the International warranty.

The warranty will not apply to components that have been subjected to faulty repair, misuse, accident, modifications, or improper installations.

Regarding equipment, components, or parts not manufactured by Dukane or its affiliates, however, this warranty shall be limited in time and extent to the warranty given to Dukane by the original manufacturer. CRTs, LCDs, touch screens (includes the entire MMI), terminals, and keyboards separate and/or incorporated as an integral part of a system will carry a six (6) month warranty.

TOOLING *12-MONTH WARRANTY, USA, CANADA, MEXICO & INTERNATIONAL*

Ultrasonic horns and fixtures are warranted for one (1) year against normal operating conditions, with the exception of horns fabricated of aluminum or steel. Aluminum and steel horns will be replaced one time only during the one–year warranty period.

Ultrasonic horns used in continuous operation will be warranted for 2,000 hours or one (1) year whichever comes first.

Replacement horns will not be warranted.

Dukane Corporation assumes no other liability for damages or wear, consequential or otherwise.

Normal wear is not covered by warranty.

Any modifications made to any horn without factory approval will void any horn or fixture warranty. In addition, unauthorized modifications to any horn could void the warranty on transducer and generator.

Appendix A

List of Figures

List of Tables

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User Supplied Circuitry

- Manual Control Switch
- Automation Control Switch
- Isolated Automation Control

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Manual Switch Circuit

Figure C–1 is an example of a typical, user supplied manual control circuit connected to the DPC Control Input conector. The switch contacts are connected to the Switch Closure Input at Pin #8 or Pin #15 and DPC Ground at Pin #7 or Pin #2.

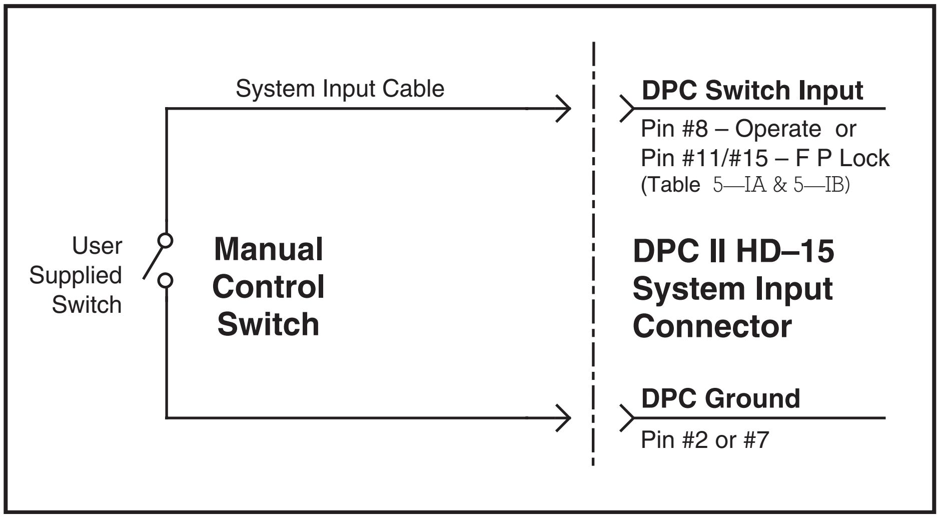


Figure C–1 Manual Control Switch

> **NOTE**
> The drawings and circuits shown in this section are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Dukane does not assume responsibility or liability for actual use based upon the examples shown in this section.

Automation Switch Circuits

Figure C–2 shows examples of various types of user supplied automation control circuits connected to the DPC Input. These examples can be used in place of the low–side or high–side switches in Figures C–3, C–4, C–5 and C–6.

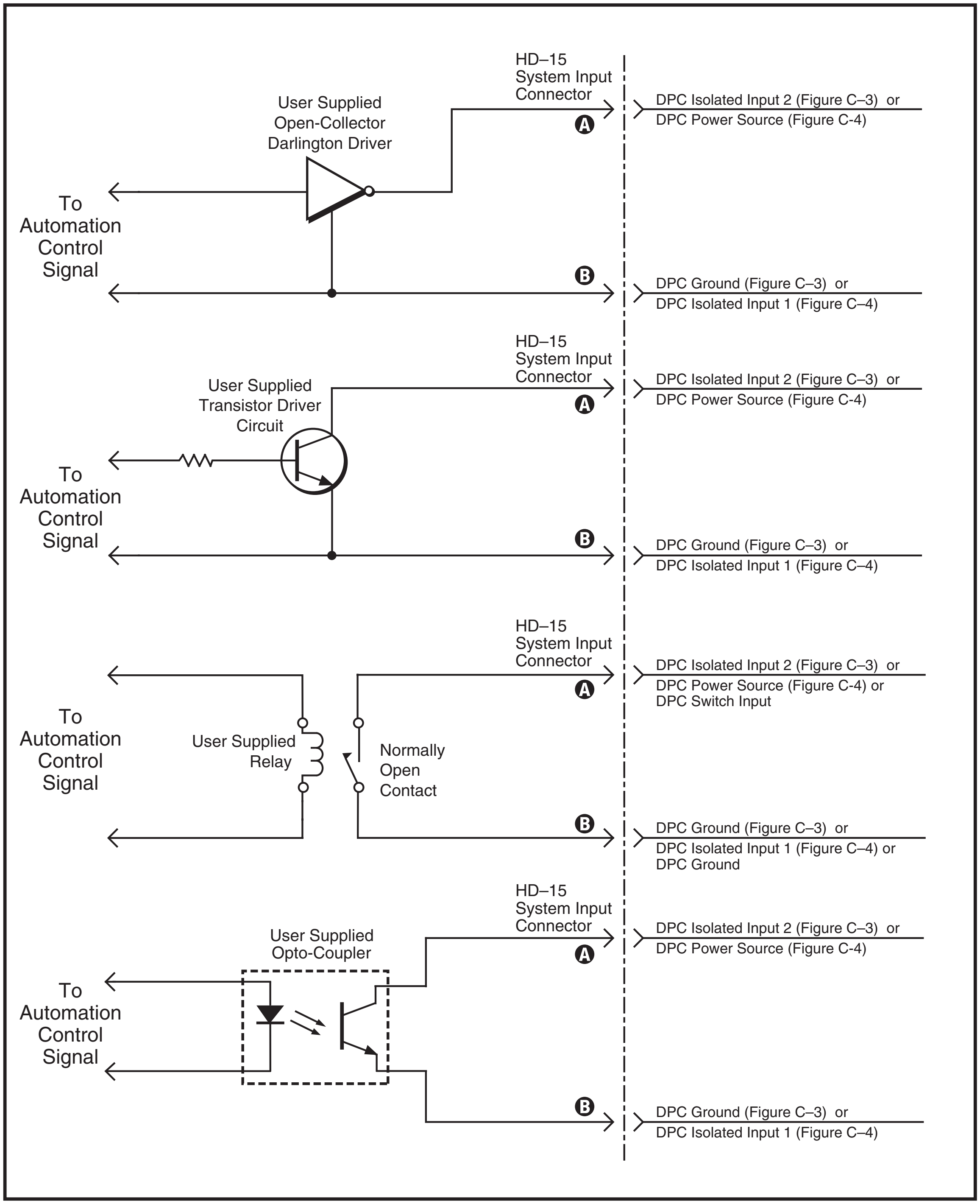


Figure C–2 Automation Control Switches

Non–Isolated Low Side Sink

Current Sink Control Circuit (Rev–1)

Figure C–3 illustrates an automation control circuit connected to the low side of one of the Isolated Automation Inputs. Even though the switch drives an Opto–Isolator, it is still connected to DPC ground and not isolated. With a Rev–1 motherboard, the SH707 jumper block should be in the factory default postion (JU724). Any of the examples in Figure C–2 can be used in place of the block labeled **Low Side Switch Sinks Current To Ground.**

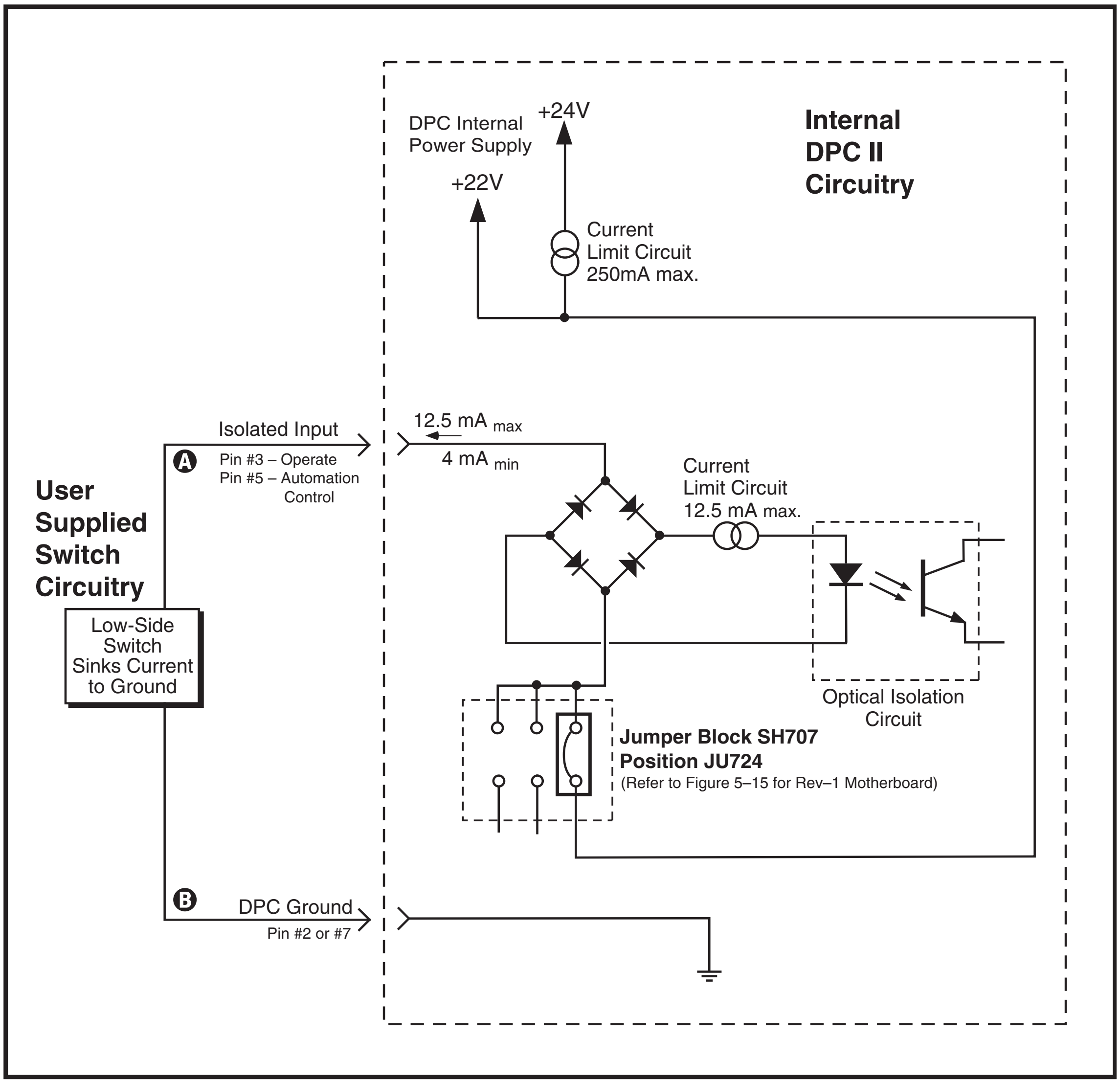


Figure C–3 Rev–1 Current Sink Switch

Current Sink Control Circuit (Rev–0)

Figure C–4 illustrates an automation control circuit connected to the low side of one of the Isolated Automation Inputs. This circuit is designed for a DPC II with a Rev–0 motherboard. Any of the examples in Figure C–2 can be used in place of the block labeled **Low Side Switch Sinks Current To Ground.**

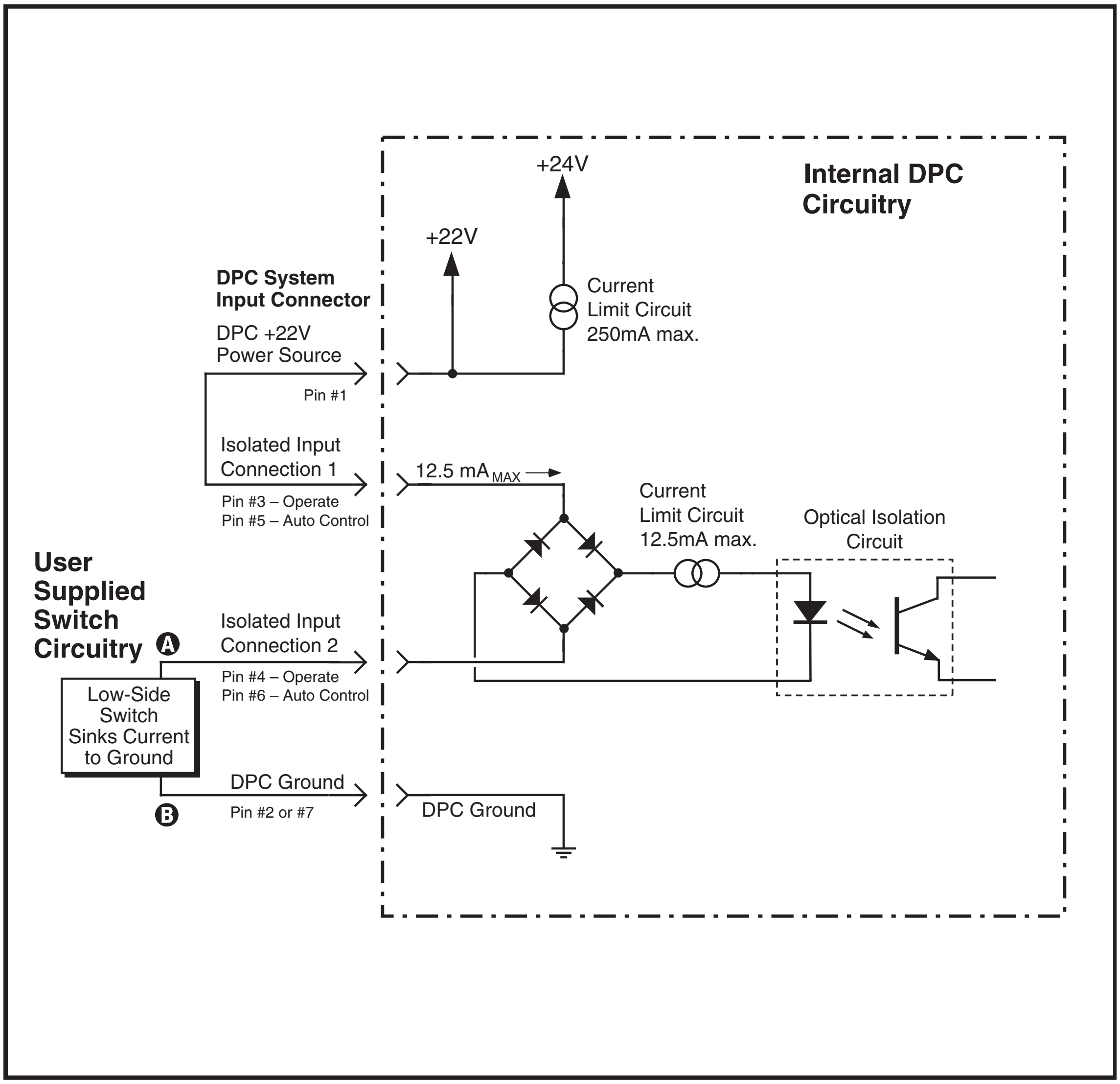


Figure C–4 Rev–0 Current Sink Switch

Non–Isolated High Side Source

Current Source Control Circuit (Rev–1)

Figure C–5 illustrates an automation control circuit connected to the highside of one of the Isolated Automation Inputs. Even though the switch drives an Opto–Isolator, it is still connected to the DPC power source and not isolated. If your DPC II has a Rev–1 motherboard, the SH707 jumper block must be in the JU725 position (see Figure 5–15). Any of the examples in Figure C–2 can be used in place of the block labeled **High Side Switch Sources Current.**

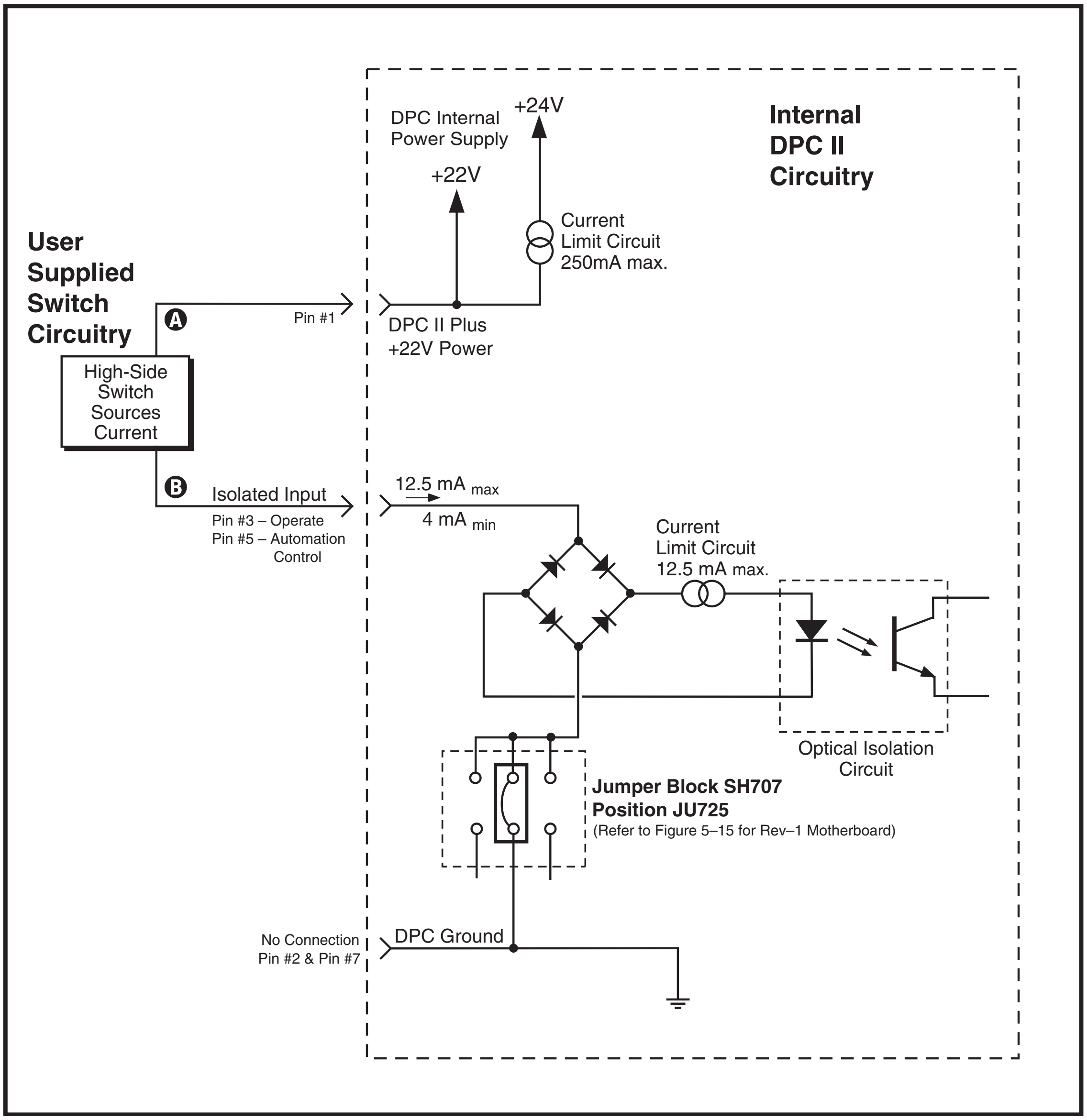


Figure C–5 Rev–1 Current Source Switch

Current Source Control Circuit (Rev–0)

Figure C–6 illustrates an automation control circuit connected to the highside of one of the Isolated Automation Inputs. This circuit is designed for a DPC II with a Rev–0 motherboard. Any of the examples in Figure C–2 can be used in place of the block labeled **High Side Switch Sources Current.**

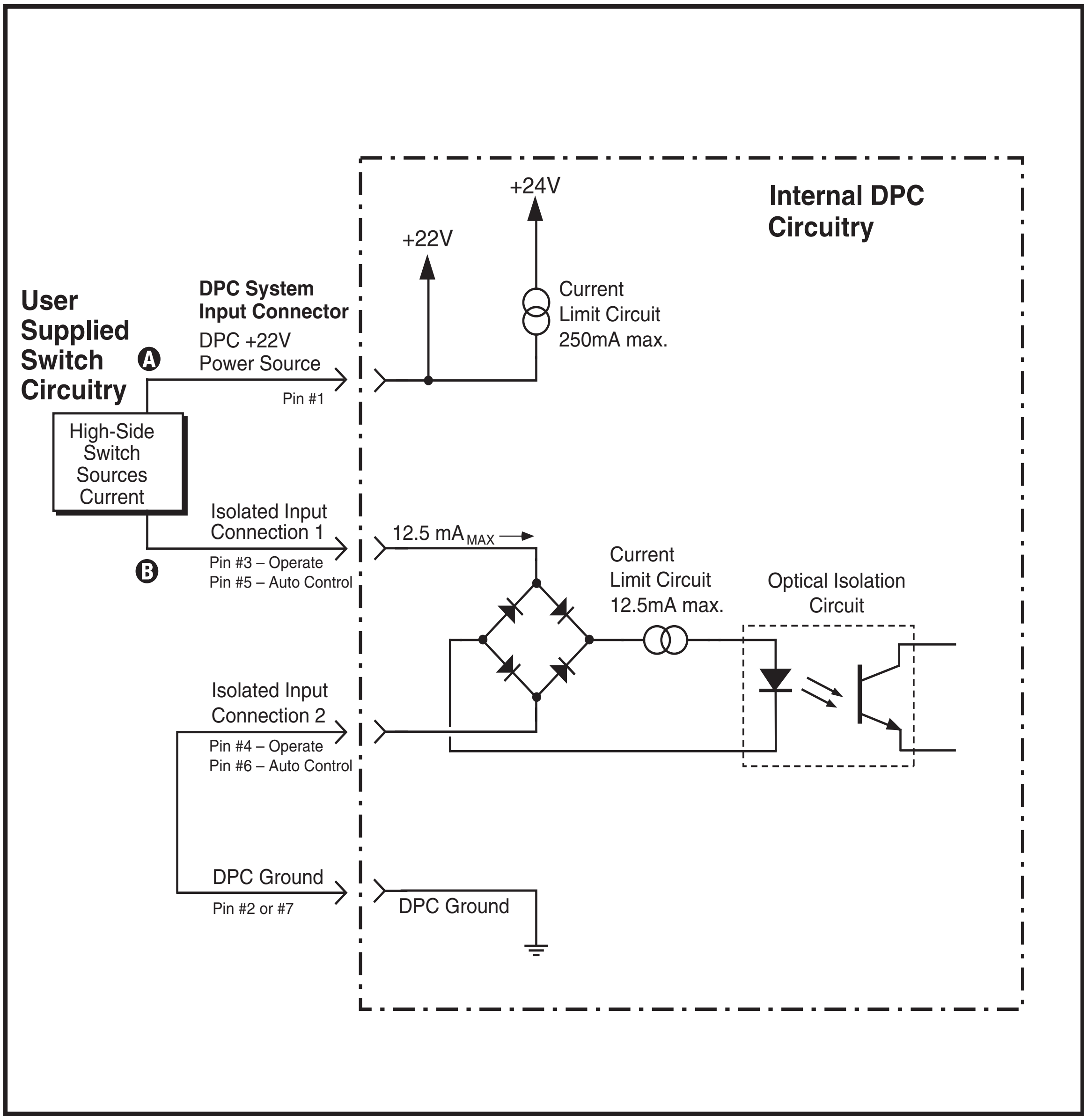


Figure C–6 Rev–0 Current Source Switch

Fully Isolated Switch Circuit

Isolated Current Source Circuit (Rev–1)

Figure C–7 illustrates a fully isolated circuit connected to the Isolated Automation Inputs. This requires an external power supply to drive the switch. With a Rev–1 motherboard, the SH707 jumper block needs to be placed in the JU726 position (refer to Figure 5–15).

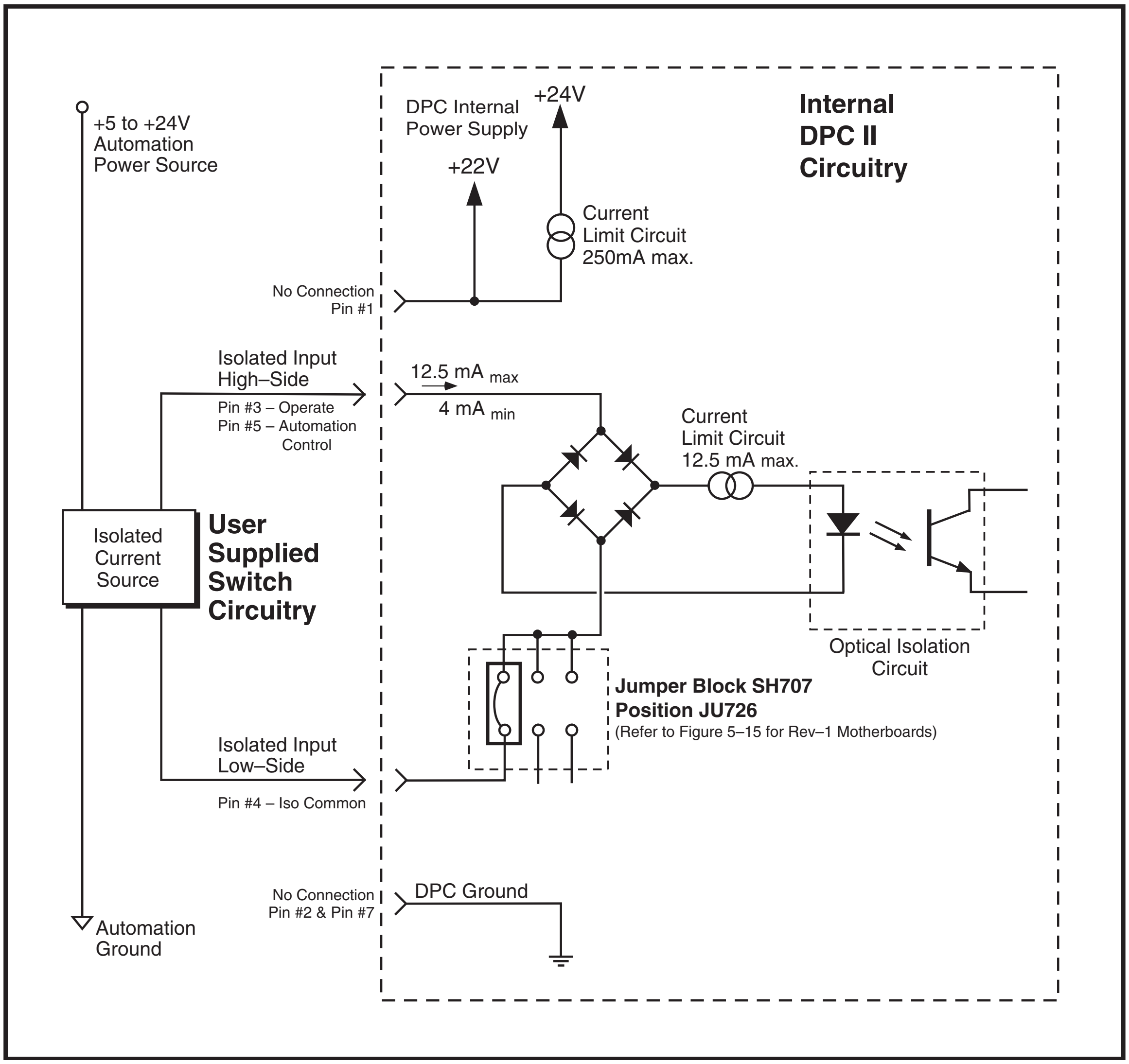


Figure C–7 Rev–1 Isolated Current Source

Isolated Current Source Circuit (Rev–0)

Figure C–8 illustrates a fully isolated circuit connected to the Isolated Automation Inputs. This requires an external power supply to drive the switch. This circuit is designed for use with a DPC II with a Rev–0 motherboard. Figure C–8 is the same as Figure C–7 except for the ommission of theSH707 jumper block.

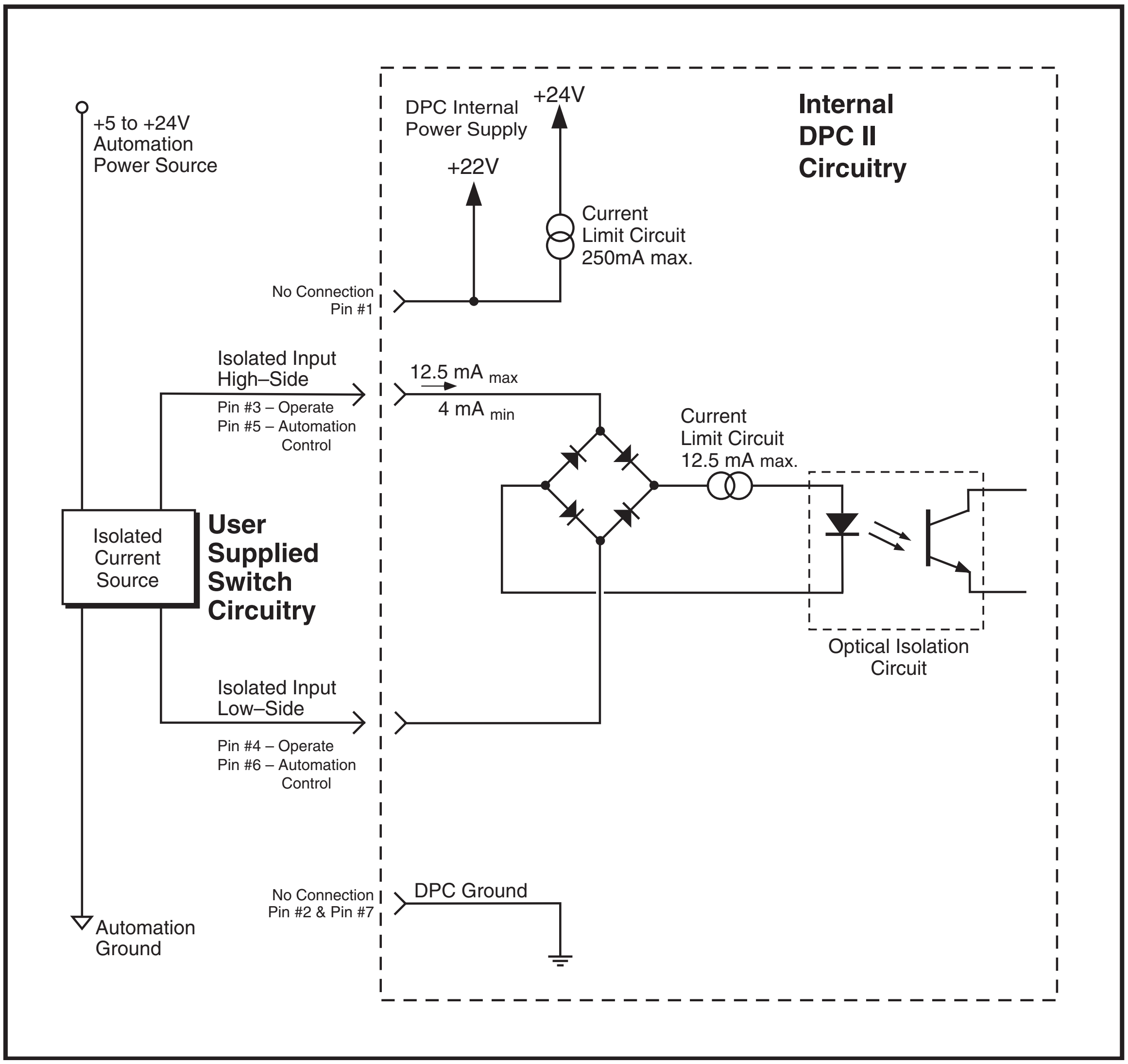


Figure C–8 Rev–0 Isolated Current Source

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Dukane ISO

ISO CERTIFICATION

Dukane chose to become ISO 9001:2000 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well–defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001:2000 certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement
3. Quality in Line Organizations and Quality System Infrastructure.

The ISO 9001:2000 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection–oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:

1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.

ISO 9001:2000
CERTIFIED
Dukane products are manufactured in ISO registered facilities

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www.dukane.com/us/sales/intsales.htm

to locate your local representative.

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